11-30-00

A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Priority Application Serial No. 09/040,813
Priority Filing Date 3/18/1998
Inventor.....Misra et al.
Applicant ..... Microsoft Corporation
Priority Group Art Unit.....2786
Priority Examiner ..... Elmore, R
Attorney's Docket No. MS1-197USC1
Title: System and Method for Software Licensing

CONTINUATION PATENT APPLICATION TRANSMITTAL

To: Commissioner of Patents and Trademarks,
Washington, D.C. 20231

From: Allan T. Sponseller (Tel. 509-324-9256; Fax 509-323-8979)
Lee & Hayes, PLLC
421 W. Riverside Avenue, Suite 500
Spokane, WA 99201

The following enumerated items accompany this transmittal letter and are being submitted for the matter identified in the above caption.

1. Transmittal Letter with Certificate of Mailing included.
2. Fee Transmittal
3. Check in the Amount of $2434.00
4. PTO Return Postcard Receipt
5. Request for Continuation Application Under 37 C.F.R. 1.53 (b)
6. True copy of the prior application as filed including the specification (57 pages, claims 1-78 & Abstract)
7. 8 Sheets Formal Drawings (Figs. 1-8)
8. Copy of Executed Declaration
9. Preliminary Amendment
10. Information Disclosure Statement, including form PTO-1449
11. Request to Approve Drawing Changes including photocopy of Fig. 3 with proposed changes in red
12. Copy of Assignment

Large Entity Status [x] Small Entity Status [ ]

The Commissioner is hereby authorized to charge payment of fees or credit overpayments to Deposit Account No. 12-0769 in connection with any patent application processing fees under 37 CFR 1.17; and any additional filing fees under 37 CFR 1.16 for the presentation of extra claims.

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PTO/SB/17 (11-00)
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FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 2434.00

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Misra
Examiner Name	
Group Art Unit	
Attorney Docket No.	MS1-1914USC1

METHOD OF PAYMENT

1. ☑ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to.
   Deposit Account Number: 12-0769
   Deposit Account Name: Lee & Hayes, PLLC
   ☑ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17
   ☐ Applicant claims small entity status. See 37 CFR 1.27
2. ☑ **Payment Enclosed:**
   ☑ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	710
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 710

2. EXTRA CLAIM FEES

		Extra Claims		Fee from below	Fee Paid
Total Claims	58	-20** =	38	X 18	= 1084
Independent Claims	16	- 3** =	13	X 80	= 1040
Multiple Dependent					=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 1724

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,240	241	620	Petition to revive - unintentional	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR 1 17(q)	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR § 1 129(a))	
149	710	249	355	For each additional invention to be examined (37 CFR § 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY				Complete *(if applicable)*	
Name (Print/Type)	Allan J. Sponseller	*Registration No. (Attorney/Agent)*	38,318	*Telephone*	(509) 324-9256
Signature				*Date*	11/28/00

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0 2 hours to complete Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231 DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS SEND TO: Assistant Commissioner for Patents, Washington, DC 20231

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. .....Not Assigned Yet
Filing Date .....November 28, 2000
Inventor..... Pradyunma K. Misra et al.
Group Art Unit .....Not Assigned Yet
Examiner .....Not Assigned Yet
Attorney's Docket No. MS1-197USC1
Title: System and Method for Software Licensing

PRELIMINARY AMENDMENT

To: Commissioner of Patents and Trademarks,
Washington, D.C. 20231

From: Allan T. Sponseller (Tel. 509-324-9256; Fax 509-323-8979)
Lee & Hayes, PLLC
421 W. Riverside Ave., Suite 500
Spokane, WA 99201

In the Specification:

Please amend the specification as follows:

On page 1, line 6, please delete the first occurrence of "been".

On page 18, line 24, please change "be" to --been--.

On page 31, line 25, please delete "a".

On page 35, line 8, please change "ganeration" to --generation--.

Please insert the following section at the beginning of the specification before the heading "Technical Field:"

--**RELATED APPLICATIONS**

This is a continuation of U.S. Patent Application Serial No. 09/040,813, filed March 18, 1998.--

In the Claims:

Please cancel claims 7, 8, 9, 11, 12, 22, 28, 37, 38, 39, 40, 41, 42, 43, 44, 58, 62, 66, 67, and 70 without prejudice.

Claims 1-6, 10, 13-21, 23-27, and 29-36 are amended.

Claims 1-6, 10, 13-21, 23-27, 29-36, 45-57, 59-61, 63-65, 68, 69, and 71-78 are pending.

Please amend claims 1-6, 10, 13-21, 23-27, and 29-36 as follows:

1. (Amended) A computer-implemented method comprising [the following steps]:

creating a license pack at a license generator, the license pack containing a set of one or more individual software licenses;

signing the license pack with a digital signature of the license generator;

issuing the license pack to a license server;

verifying, at the license server, the license generator's digital signature on the license pack; and

distributing the software licenses contained in the license pack from the license server to corresponding clients.

2. (Amended) A computer-implemented method as recited in claim 1, further comprising [the step of] creating a license pack containing a predefined number of software licenses.

3. (Amended) A computer-implemented method as recited in claim 1, further comprising [the following steps]:

creating a license pack ID at the license generator; and

evaluating the license pack ID at the license server.

4. (Amended) A computer-implemented method as recited in claim 1, further comprising [the following steps]:

encrypting the license pack at the license generator; and

decrypting the license pack at the license server.

5. (Amended) A computer-implemented method as recited in claim 1, further comprising [the step of] creating a license pack that is tailored to a particular operating platform of the clients.

6. (Amended) A computer-implemented method as recited in claim 1, further comprising [the step of] determining an authenticity of an individual client prior to distributing the software license to that individual client.

10. (Amended) A computer-implemented method as recited in claim 1, wherein the license pack has a license pack ID, and further comprising [the step of] granting additional licenses for the license pack having the same license pack ID.

13. (Amended) A computer-implemented method for distributing software licenses to clients so that the clients may legally execute underlying software to which the software licenses pertain, the computer-implemented method comprising [the step of] electronically issuing the software licenses as digital certificates that can be distributed in one-to-one correlation with individual clients and traced to an issuing authority.

14. (Amended) A computer-readable medium having computer readable instructions for performing the [step] method as recited in claim 13.

15. (Amended) A computer-implemented method comprising [the following steps]:

receiving a request for a software license from a particular license server;

creating a license pack containing a set of one or more individual software licenses;

assigning a license pack ID to the license pack;

associating the license pack ID with the particular license server;

digitally signing the license pack; and

issuing the signed license pack to the particular license server.

16. (Amended) A computer-implemented method as recited in claim 15, further comprising [the step of] creating a license pack containing a predefined number of software licenses.

17. (Amended) A computer-implemented method as recited in claim 15, further comprising [the step of] creating a license pack that includes a platform type indicating a type of operating platform for which the software licenses can be used.

18. (Amended) A computer-implemented method as recited in claim 15, further comprising [the step of] creating a license pack that includes a predefined number of software licenses, a platform type indicating a type of operating platform for which the software licenses can be used, an expiration date indicating a date on which the software licenses will expire, and a product ID that identifies a product with which the software licenses can be used.

19. (Amended) A computer-implemented method as recited in claim 15, further comprising [the step of] encrypting the license pack.

20. (Amended) A computer-readable medium having computer readable instructions for performing the [steps] <u>method</u> as recited in claim 15.

21. (Amended) A computer-implemented method comprising [the following steps]:

receiving a request for a software license from a particular client;

determining an authenticity of the particular client;

selecting a software license from a pack of software licenses that is appropriate for the particular client, the software license having an associated license ID;

associating the license ID with the particular client; and

granting the software license to the particular client.

23. (Amended) A computer-implemented method as recited in claim 21, further comprising [the step of] granting the software license as containing the license ID, a platform type indicating a type the platform, an issue date indicates a date on which the license is issued to the client, an expiration date that indicates a date on which the software license will expire, a product ID that identifies a product with which the software licenses can be used, a client ID that identifies the particular client, and a version of the software license.

24. (Amended) A computer-implemented method as recited in claim 21, wherein [the step of] determining the authenticity comprises [the following steps]:

receiving a client software ID from the particular client; and

evaluating the client software ID to determine whether the client is authentic.

25. (Amended) A computer-implemented method as recited in claim 21, wherein [the step of] determining the authenticity comprises [the following steps]:

maintaining a set of client images;

receiving a client software ID from the particular client; and

comparing the client software ID to the client images to evaluate whether the client is authentic.

26. (Amended) A computer-implemented method as recited in claim 21, further comprising [the following steps]:

determining a platform of the particular client; and

selecting the software license as is appropriate for the platform of the particular client.

27. (Amended) A computer-implemented method as recited in claim 21, further comprising [the step of] encrypting the software license using a public key of the particular client.

29. (Amended) A computer-readable medium having computer readable instructions for performing the [steps] method as recited in claim 21.

30. (Amended) A computer-implemented method comprising [the following steps]:

computing, at a computer, a value as a one-way function of a client executable image that uniquely identifies a client; and

digitally signing the value, at the computer, using a private signing key of a server that serves the client to create a client image digital signature that is unique to the client.

31. (Amended) A computer-implemented method as recited in claim 30, wherein [the] computing the value [step] comprises [the step of] hashing the executable image to produce a hash value.

32. (Amended) A computer-implemented method as recited in claim 30, further comprising [the step of] storing the client image digital signature at the client.

33. (Amended) A computer-implemented method as recited in claim 30, further comprising [the following steps]:

storing the client executable image at the server;

storing the client image digital signature at the client;

submitting the client image digital signature from the client to the server when requesting a software license; and

evaluating an authenticity of the client based on the client image digital signature prior to granting a software license to the client

34. (Amended) A computer-implemented method as recited in claim 33, wherein [the] evaluating the authenticity [step] comprises [the following steps]:

unsigning the client image digital signature using a public key of the server to recover the client executable image; and

comparing the recovered client executable image to the client executable image stored at the server.

35. (Amended) A computer-implemented method as recited in claim 34, further comprising [the step of] rejecting the request for a software license in an event that the recovered client executable image does not match the client executable image stored at the server.

36. (Amended) A computer-readable medium having computer readable instructions for performing the [steps] method as recited in claim 30.

REMARKS

Applicant respectfully requests entry of this amendment before examination of the subject application.

In an Office Action of the priority application (U.S. Patent Application Serial No. 09/040,813), several claims were rejected under 35 U.S.C. §103(a) by a combination of references including U.S. Patent No. 5,790,677 to Fox et al. Given that the filing date of the subject application is after November 29, 1999, Applicant respectfully submits that the Fox et al. patent, which is assigned to the same Assignee as the subject application, is not a useable prior art reference under 35 U.S.C. §103(a) for the subject application.

Applicant respectfully requests prompt issuance of the subject application.

Respectfully Submitted,

Date: 11/28/00

By: _____
Allan T. Sponseller
Reg. No. 38,318
(509) 324-9256

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR LETTERS PATENT

System and Method for Software Licensing

Inventor(s):
Pradyunma K. Misra
Bradley J. Graziadio
Terence Spies

ATTORNEY'S DOCKET NO. MS1-197US

TECHNICAL FIELD

This invention relates to systems and methods for licensing software. This invention further relates to systems and methods for enforcing software licenses.

BACKGROUND

Software licensing has been historically been based on a "trust" model in which the user (i.e., licensee) is presumed to be honest and trustworthy and to abide by the legal requirements of the license. Under the trust model, a software license typically accompanies a software product to explain the terms of use. For instance, the software license might dictate that the program code is to be installed on only one computer, and may be used to make one backup copy.

Common types of licenses include "shrink wrap" licenses, "online" licenses, and "site" licenses. A "shrink wrap" license is a license that accompanies each software product that is sold individually in a shrink-wrapped package through retail stores. The user is typically assumed to accept the terms of the shrink wrap license upon breaking the seal of the package, or the container that holds the disk itself.

An "online" license is one that accompanies software products that are downloaded online, such as from the Internet. The license is typically presented to the user prior to downloading the code. The user is presented with a choice to accept or reject the license. If the user accepts the license (e.g., by clicking an "Accept" button on the screen), the user is presumed to have accepted the terms of the license and the code is downloaded to the user's computer.

A "site" license is a single license that allows installation of multiple copies of software on many different computers at a particular site or many sites. It is

commonly used to sell software to corporations, firms, or other entities having many computers. The purchaser pays for a certain number of copies (e.g., hundreds or thousands), and the site license enables the purchaser to install that many copies on its computers. The site license is beneficial because the software vendor need not supply a large number of program disks, but merely supplies one or a few copies of the software and lets the purchaser install the copies without violating the agreement.

Each of the above license arrangements assumes that the purchaser is honest. The software purchaser must abide by the license terms in order to legally use the software. If the purchaser fails to abide by the provisions, the purchaser can be charged with civil and criminal violations.

However, enforcement of such licenses is impractical, if not impossible. Unscrupulous users might make multiple copies of the software code and install it on more computers than the license allows. Yet, software vendors cannot begin to monitor these abuses because they occur in the privacy of the home or company. Thus, it is believed that the software industry loses a large percentage of revenues each year simply due to illegitimate use of software by the licensees. This loss does not even account for the problems of overseas pirating.

Another problem with conventional software licensing practices concerns internal monitoring and bookkeeping on the part of large-site licensees. In most cases, the licensees want to comply with the terms of the software licenses, but are unable to adequately track the software as it is used throughout the site. For example, a large corporation might purchase several thousand copies of the software and begin installing the copies. However, computers and personnel change over time and it is difficult to centrally monitor how many copies have

been installed, whether the copies have expired, whether they need upgrading, and so forth.

Accordingly, there is a need to develop a new approach to licensing software in a manner that assures that the terms are being meet and assists the licensee with monitoring whether it is in compliance with the software license.

SUMMARY

This invention concerns a system and method for licensing software. The system and method provides confidence to the vendor that the software license is being complied with, while also assisting the purchaser in monitoring its own compliance with the license.

According to one aspect of this invention, computer software licenses are electronically issued as digital certificates that can be distributed in one-to-one correlation with individual client computers and traced to an issuing authority.

According to another aspect, the system includes a license generator located at a licensing clearinghouse and at least one license server and multiple clients located at or affiliated with a company or other entity. Because the clients might not have network connectivity to the license server, one or more intermediate servers may act as an intermediary for the clients. These intermediate servers are otherwise common servers that provide resources to clients, but with the added ability to facilitate connectivity to the license server for purposes of distributing software licenses to the clients.

When a company wants a software license, it sends a purchase request (and an appropriate fee) to the licensing clearinghouse. The license generator at the licensing clearinghouse creates a license pack containing a set of one or more

individual software licenses. To prevent the license pack from being copied and installed on multiple license servers, the license generator assigns a unique license pack ID to the license pack and associates the license pack ID with the license server in a master license database kept at the licensing clearinghouse. The license generator also digitally signs the license pack and encrypts it with the license server's public key. The license generator sends the license pack to the license server using standard communications, such as over a data communication network (e.g., Internet) or via a portable data medium (e.g., floppy diskette, CD-ROM, etc.).

The license server verifies the license generator's digital signature on the license pack and if valid, installs the license pack for subsequent distribution of licenses. The license server maintains an inventory of software licenses that have been purchased from the licensing clearinghouse. The license server is responsible for distributing the software licenses contained in the license pack to individual clients. It monitors the software licenses that have been granted to clients and continues to distribute licenses as long as non-assigned licenses remain available. Once the supply of non-assigned licenses is exhausted, however, the license server can no longer grant licenses to the clients and the customer must purchase a new pack from the license clearinghouse.

When a client connects to a server, the client presents a valid license (if it has one). If the client does not have an appropriate license, the server assists the client in obtaining a license from the license server. This provides an automated mechanism for clients to obtain and license server to distribute licenses to clients.

When a license is requested, the license server initially checks if the requesting client has already been issued a license. When this situation is detected,

the license server issues the existing license to the client. This is actually reissuing of the same license that was previously issued. This allows the client to gracefully recover licenses when they are lost.

In one implementation, the license server determines an appropriate type of license based in part on the client's operating system platform. The license server derives the platform information by establishing a trust relationship with the client and then querying its platform type. If a software license is available for allocation, the license server grants a software license that is appropriate for the client's platform.

To prevent an issued license from being copied from one client machine to another, the software license is assigned to a specific client by including its client ID within the license. The software license also has a corresponding license ID that is associated with the client ID in a database record kept at the license server.

The license server digitally signs the software license. The license is passed to the client, where it is stored in a local cache at the client. Once a client has obtained a license, it is responsible for managing the storage of that license.

BRIEF DESCRIPTION OF THE DRAWINGS

The same reference numbers are used throughout the drawings to reference like components and features.

Fig. 1 shows a software licensing system.

Fig. 2 shows a block diagram of a computer used to implement the software licensing system.

Fig. 3 shows a functional block diagram showing software components and databases that implement the software licensing system.

Fig. 4 shows steps in a method for issuing a license pack of individual licenses.

Fig. 5 shows steps in a method for initiating a connection between a client and a server and determining whether the client has a valid license.

Fig. 6 shows steps in a method for distributing a software license to a client.

Fig. 7 shows steps in a method for challenging a client prior to granting a software license to that client.

Fig. 8 shows steps in a method for upgrading a software license.

DETAILED DESCRIPTION

The following discussion assumes that the reader is familiar with public key cryptography. For a basic introduction to cryptography, the reader is directed to a text written by Bruce Schneier and entitled, "Applied Cryptography: Protocols, Algorithms, and Source Code in C," published by John Wiley & Sons, copyright 1994 (second edition 1996), which is hereby incorporated by reference.

Fig. 1 shows a system 20 for licensing software. The system 20 has a licensing clearinghouse 22 that creates and issues valid software licenses to one or more companies, firms, agencies, or other entities, as represented by company 24. The clearinghouse 22 is a separate entity from the company 24. Examples of the clearinghouse include a software manufacturer, a software vendor, or a third party agent that is authorized to issue software licenses on behalf of the software manufacturer or vendor.

The company 24 contacts the clearinghouse 22 when it desires to purchase a software license to run software on the company computers. The clearinghouse 22 has a license generator 26 that creates a "license pack" containing a set of one or

more individual software licenses. The clearinghouse 22 encrypts the license pack using the destination license server's public key and digitally signs the license pack with a digital signature unique to the clearinghouse.

The company 24 has at least one designated license server 28. The license pack is sent to the company 24 using standard communications, such as over a data communication network (e.g., Internet) or via a portable data medium (e.g., floppy diskette, CD-ROM, etc.), and installed on the license server 28.

The license server 28 is responsible for distributing the software licenses contained in the license pack to individual clients, as represented by clients 30(1)-30(6). The license server 28 verifies the license generator's digital signature on the license pack, decrypts the contents of the license pack, and stores the individual software licenses for subsequent distribution to individual clients.

The license server 28 maintains an inventory of software licenses that have been purchased from the licensing clearinghouse 22. The license server 28 monitors the software licenses that have been granted to clients. The license server 28 can distribute licenses to new clients as long as it has available non-assigned licenses. Once the supply of non-assigned licenses is exhausted, however, the license server 28 can no longer grant licenses to the clients. The only way for the license server 28 to obtain new non-assigned licenses is to purchase a license pack from the clearinghouse 22.

Because the clients might not have network connectivity to the license server 28, one or more intermediate servers, as represented by servers 32(1) and 32(2), can act as an intermediary for the clients. Each intermediate server 32 is a common server that provides conventional resources to the clients. In addition, each intermediate server 32 has network connectivity to the license server 28 to

facilitate license distribution from the license server 28 to the clients 30. The intermediate servers 32 accept software licenses issued by the license server 28; therefore, the intermediate server associations determine the scope of the license pack to a particular license server.

The clients 30 may be directly coupled to the intermediate servers 32 via a LAN (local access network) or WAN (wide area network), as represented by clients 30(1)-30(4). Additionally, the clients 30 may be indirectly coupled to the intermediate servers 32, such as using a dialup connection as represented by clients 30(5) and 30(6).

When a client 30 connects to the intermediate server 32, it must present a valid license. If the client does not have an appropriate license, the intermediate server 32 assists the client in obtaining a license from the license server 28. This provides an automated mechanism for distributing licenses to clients. The license server 28 initially checks if the requesting client already has been issued a license. When this situation is detected, the license server 28 issues the existing license to the client. This allows the client to gracefully recover licenses when they are lost.

In one particular implementation, the license server 28 determines an appropriate type of license based in part on the client's platform operating system type. The license server 28 derives the platform information by establishing a trust relationship with the client 30 and then querying its platform type. Once a client 30 has obtained a license, it is responsible for managing the storage of that license. The platform challenge process is described below in more detail.

Exemplary Computer Used to Implement Servers and/or Client

The license generator 26, license server 28, and intermediate server 32 are preferably implemented as computer servers, such as Windows NT servers that run Windows NT server operating systems from Microsoft Corporation or UNIX-based servers. It is noted, however, that the license generator 26 and license server 28 may be implemented using other technologies, including mainframe technologies, as long as they share an inter-operable communication mechanism like remote procedure call (RPC) and these systems are secure.

The clients 30 can be implemented as many different kinds of computers, including a desktop personal computer, a workstation, a laptop computer, a notebook computer, a handheld PC, and so forth. The clients 30 may further represent a terminal device, which is a low cost machine with limited local processing and local memory. The terminal device includes a display, a keyboard, a mouse (optional), limited computer resources like memory, and enough intelligence to connect to an intermediate server. All applications run at the server. The terminal merely provides a connection point to the server-based processing.

The clients 30 might also represent a network-centric computer, such as a Network Computer (or NC) or a Net PC.

Fig. 2 shows an example implementation of a computer 40, which can be used to implement the license generator 26, license server 28, and intermediate server 32. The server 40 includes a processing unit 42, a system memory 44, and a system bus 46 that interconnects various system components, including the system memory 44 to the processing unit 42. The system bus 46 may be implemented as any one of several bus structures and using any of a variety of bus architectures, including a memory bus or memory controller, a peripheral bus, and a local bus.

The system memory 44 includes read only memory (ROM) 48 and random access memory (RAM) 50. A basic input/output system 52 (BIOS) is stored in ROM 48.

The computer 40 has one or more of the following drives: a hard disk drive 54 for reading from and writing to a hard disk or hard disk array, a magnetic disk drive 56 for reading from or writing to a removable magnetic disk 58, and an optical disk drive 60 for reading from or writing to a removable optical disk 62 such as a CD ROM or other optical media. The hard disk drive 54, magnetic disk drive 56, and optical disk drive 60 are connected to the system bus 46 by a hard disk drive interface 64, a magnetic disk drive interface 66, and an optical drive interface 68, respectively. The drives and their associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for the computer 40.

Although a hard disk, a removable magnetic disk 58, and a removable optical disk 62 are described, other types of computer readable media can be used to store data. Other such media include magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read only memories (ROM), and the like. Additionally, the computer 40 may be configured to serve data stored on an independent storage systems, such as disk array storage systems.

A number of program modules may be stored on the hard disk, magnetic disk 58, optical disk 62, ROM 48, or RAM 50. These programs include a server operating system 70, one or more application programs 72, other program modules 74, and program data 76. The operating system 70 is preferably a Windows-brand operating system such as Windows NT, Windows 95, Windows CE or other form

of Windows. The operating system 70 may alternatively be other types, including Macintosh and UNIX-based operating systems.

A user may enter commands and information into the computer 40 through input devices such as a keyboard 78 and a mouse 80. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are connected to the processing unit 42 through a serial port interface 82 that is coupled to the system bus 46, but may alternatively be connected by other interfaces, such as a parallel port, game port, or a universal serial bus (USB).

A monitor 84 or other type of display device is also connected to the system bus 46 via an interface, such as a video adapter 86. The computer 40 has a network interface or adapter 88, a modem 90, or other means for establishing communications over a network 92.

System Architecture

Fig. 3 shows an exemplary software/hardware architecture of the system 20. The architecture includes four components: a license generator 26, a license server 28, a client 30, and an intermediate server 32. The license generator 26 produces license packs for a fee and the license server 28 consumes the licenses by installing them. In turn, the license server 28 distributes a license to the client 30 with the help of the intermediate server 32. The client 30 then uses the license to gain access to the resources provided by the intermediate server 32.

The entity or organization that owns, or is responsible for, the license server 28 registers itself with an independent certifying authority that is trusted by both the organization and the clearinghouse. The organization submits information

identifying itself and various license servers to the certifying authority. The certifying authority performs a verification analysis of the organization to verify that it is a real entity and that the identification information is true and accurate. The certifying authority issues a certificate to the organization. The certificate contains the public key of the organization (or particular license server), which is signed by the certifying authority. This certificate becomes the license server's certificate during the initial purchase request process when the license server requests a license pack from the clearinghouse.

Similarly, the clearinghouse also registers with the certifying authority to receive a public certificate. The clearinghouse certificate contains the clearinghouse's public key, signed by the certifying authority.

The license generator 26 has a master license database 100, a licensing producer 102, and a request handler 104. The request handler 104 receives a purchase request 106 from the license server 28 asking to purchase one or more license packs. The purchase request includes information pertaining to the licenses and license server 28. For example, the purchase request might contain such information as a license server ID, the license server's certificate (which contains the license server's public key), a client's platform type, the quantity of licenses desired, a product ID, and a list of features that the licenses should enable. Additional information about a customer (e.g., name, contract number, etc.) may also be requested for purposes of tracking and report generation. This information is stored in the master license database 100.

In response to the request, the license producer 102 generates one or more license packs 108, each of which contains a set of one or more non-assigned licenses that are purchased from the license clearinghouse. The license generator

26 creates licensing packs in a way that prevents them from being copied and installed on multiple license servers 28 or being applied multiple times on the same server. In the preferred implementation, this is accomplished using IDs and cryptographic tools. The license producer 102 assigns a unique license pack ID to each license pack and associates the license pack ID with the license server 28 in the master license database 100. The license pack ID is embedded in the license pack 108. This prevents users from multiplying the number of licenses they purchase by installing the same license pack multiple times on the same license server.

The license generator 26 encrypts the license packs 108 with the license server's public key to ensure protected transport to the license server 28 and to ensure that only the license server 28 can open the packs 108. The license generator 26 also digitally signs the license packs 108 with a private signing key of the license generator 26. The license server 28 uses this signature to validate that the license pack came from an authorized license generator and has not been altered.

The license pack 108 is a data structure that contains various information to enable the license server to distribute software licenses. The data structure contains fields with the licensing information. Table 1 shows the data fields of a license pack data structure.

Table 1: License Pack Contents

Field	Description / Purpose
Message Version	An ID used to distinguish different versions of the data structure.
License Pack Serial	A serial number assigned by the license

Number	generator to prevent the license pack from being installed multiple times on the same license server.
Issue Date	The date the license pack is issued by the clearinghouse.
First Active Date	The date on which the licenses within the license pack can first be used.
Expiration Date	The date on which the licenses within the license pack will expire. A license could be set such that it does not expire.
Begin Serial Number	The beginning serial number for the licenses in the license pack. The number is used to assign a unique serial number to each license within the license pack.
Quantity of Licenses	The number of licenses contained within the license pack.
Number of Human Descriptions	The number of Human descriptions included for the license pack.
Array of Human Descriptions (Locale, Description)	Locale—Identifies the locale for the Human Description. Human Description—A description of the contents of the license pack in a localized form.
Manufacturer	Identity of the manufacturer of the product being licensed.

Manufacturer-Specific Product Data	Manufacturer-dependent information used to identify the product. As an example, this data might include: 1. Product Family Code 2. Product Version 3. License Type
Signature	Digital signature generated by the license generator using the clearinghouse private key.
Clearinghouse's Public Key Certificate	The certificate issued to the clearinghouse and containing the clearinghouse's public key. This public key is used to sign the encrypted license pack.

One parameter of the purchase request and subsequent license pack is the client platform type. As one possible implementation, the system 20 is configured to reliably recognize four different platform types: Windows, Non-Windows, Legacy, and Direct-Connect. A "Windows"-type platform means the client computer runs a 32-bit version of Microsoft Windows operating system (e.g., Windows 95, Windows 98, Windows NT, etc.). A "Non-Windows"-type platform means the client computer runs an operating system other than a Windows brand operating system. A "Legacy"-type platform indicates that the client runs an older version of an operating system that cannot be adequately determined by the license server as a "Windows"-type or a "Non-Windows"-type. A "Direct-Connect" platform means the client is a terminal that attaches directly to the server's bus and

thus, all of the operating system functionality is provided directly by the server. Table 2 summarizes the platform types.

Table 2: Platform Types

Platform Type	Description
Windows	Authenticated client platforms that are Win32-based.
Non-Windows	Authenticated client platforms that are not Win32-based.
Legacy	Clients that are implemented with older operating systems that are incapable of fielding a client platform challenge from the license server. There is no way of determining whether or not the client's platform is Win32 capable.
Direct-Connect	Multi-console clients that are attached directly to the server's BUS. These clients derive the operating system capabilities from the server itself.

The license server 28 has a license pack installer 110 and a secure license store 112. The license pack installer 110 installs the license pack(s) 108 received from the license generator on the secure license store 112. The license pack installer 110 may also be used to order the license packs, when such purchase requests are made electronically.

The license pack is stored in a secured database. A library of routines for adding, removing, querying, upgrading and extracting licenses are used to manage the licenses within the license store. As noted above, the license packs are encrypted using the license server's private key to prevent users from tampering

with the licenses or moving them to another license server. License store APIs (application program interfaces) are used to encrypt the licenses as they are placed on the secure license store 112 and to decrypt the licenses as they are removed from the store.

To prevent the same licenses from being applied multiple times on the same license server, each license pack 108 contains a unique license pack ID assigned by the license generator 26 when the license pack is created. The licenses are stored in the license store 112 based on the license pack ID.

The license store 112 contains two tables: a license pack (LP) table 114 and a client assignment (CA) table 116. The license pack table 114 records information pertaining to the license packs 108. The license pack table 114 is indexed using the license pack ID, which enables quick access and a convenient way to check if a particular license pack is already installed in the secure store.

Table 3 shows the fields in the license pack table 114.

Table 3: License Pack Table

Field	Description
License Pack ID	A unique identifier assigned by the license generator.
Quantity	The number of software licenses contained in the license pack.
Number Assigned	The number of software licenses that have been assigned to clients.
First Active Date	The date on which the licenses within the license pack can first be used.
Expiration Date	The date on which the software licenses in the license pack will expire.
Begin Serial Number	The beginning serial number for the licenses in the license pack. The number is used to assign a unique serial number to each license within the license pack.
Product-Specific Attributes	Product-dependent information to indicate specific features of a product. As an example, this date might include: 1. Product ID 2. Product Flags 3. Platform Type

The number assigned field need not be kept, but it helps eliminate the need to count the number of assigned licenses each time an administrator wants to determine how many free licenses are available.

The client assignment table 116 contains a list of all licenses that have be distributed to the clients. Each record in the client assignment table 116 is

assigned a unique license ID. The license ID serves two purposes: (1) it allows the table 116 to be indexed and (2) it provides a license tracking mechanism for the client. The client assignment table 116 also contains the license pack ID from which each license is derived.

Table 4 shows the fields in the client assignment table 116.

Table 4: Client Assignment Table

Field	Description
License ID	A unique identifier assigned by the license server to each software license, based on the begin serial number.
License Pack ID	The unique identifier assigned by the license generator.
Client ID	A unique identifier of the client to which the software license is granted.
Issue Date	The date on which the software license is issued to the client.

The license pack ID fields in the license pack table 114 and the client assignment table 116 can be used to join the tables in a one-to-many relationship; that is, one record identified in the license pack table 114 to many records in the client assignment table 116 as software licenses are issued to clients. This joinder yields a list of all software licenses assigned to clients from a given license pack. The client ID field enables the administrator to query all licenses for a particular client.

In this manner, the two tables 114 and 116 help the company's license administrator track the number of licenses available, the number installed, and which clients have which licenses. This tracking mechanism is useful because the administrator can quickly determine whether the company is in compliance with the terms of the license. Additionally, the tracking mechanism allows the administrator to plan for purchasing of additional licenses.

With continuing reference to Fig. 3, the license server 28 also has a client image installer 118 and a client image cache 120. The client image installer 118 installs executable images and client signatures of authorized clients in the client image cache 120. The client images are used to challenge clients during software distribution. The reason that the entire client image is stored on the license server is to prevent a third party from replaying exchanges between client and server for platform challenge and response.

The client digital signatures are based on client information provided by the manufacturer (i.e., OEM). The OEM submits a client executable image to a third party, or to the software manufacturer of the server software, or to a signing authority (hereinafter, collectively referred to as the signing authority). The signing authority computes a value as a one-way function of a client executable image. Preferably, the signing authority hashes the image, or slices of the image, using a hashing algorithm to produce a hash value. The signing authority then signs the client image hash with a private key associated with the license server.

The client's digital signature is presented to a license server 28 when installing client images in the server's client image cache 120. The client image installer 118 has access to the corresponding public key, which is maintained at the

license server, and uses this public key to verify the client's signature before installing the client image on the cache 120.

The license server 28 also has a request handler 122, a client authenticating module 124, and a granting module 126. The request handler 122 receives requests for software licenses from clients. The client request typically includes the client ID. The request handler 122 passes the request to the client authenticating module 124, which determines whether the client is authentic and able to receive a software license.

As part of the authentication process, the client authenticating module 124 initiates a platform challenge requesting a client executable image from the client 30. One preferred approach to performing a platform challenge is described below in more detail under the sub-heading "Platform Challenge".

The client authenticating module 124 compares the client executable image received from the client to the client executable image stored in the client image cache 120. The client is deemed authentic if the two images match. The client authenticating module 124 informs the granting module 126 when the client is authenticated.

The granting module 126 grants a software license from the secure license store 112 to the authenticated client. To prevent an issued license from being copied from machine to machine, the software license is assigned to a specific client by assigning a client ID to the license and including that ID within the license. The software license is also given a license ID. The license ID is associated with the client ID in the client assignment table 116 to track which client receives the issued license.

The license server 28, based on information derived from the license pack, fills in fields of a license data structure at the time the license is issued. As one example, the license data structure is implemented using an X.509 certificate, which is well known in the art. The license server 28 then digitally signs the software license using a signing key that is not disclosed to the client. Table 5 shows the data fields of a software license data structure.

Table 5: Software License Contents

Field	Description / Purpose
Version	Identifies the "data structure" version of the software license so newer licenses can be used on older servers.
License ID	A unique ID assigned to the software license by the license server at the time of issuance to the client.
Client ID	The unique identifier of the client to which the software license is assigned.
Issue Date	The date on which the software license is assigned to the client.
Expiration Date	The date on which the software licenses in the license pack will expire.
Product-Specific Attributes	Product-dependent information to indicate specific features of a product. As an example, this date might include: 1. Product ID 2. Product Flags 3. Platform Type
Signature	Digital signature generated by the license generator using the clearinghouse private key.

License Server's Certificate	The license server's public key in certificate form, as issued by the certifying authority.

As part of the granting process, the client assignment table 116 is updated to reflect that a particular license having a specific license ID is issued to a particular client having a specific client ID. Additionally, the number assigned field in the license pack table 114 is updated to reflect that another license has been assigned to a client.

The license pack installer 110, client image installer 118, request handler 122, client authenticating module 124, and granting module 126 are preferably implemented as software programs executing on the license server 28. These software programs are preferably implemented as part of the operating system at the license server.

The intermediate server 32 acts as a go between for the client 30 and license server 28. The intermediate server is a full-service server that is used regularly by the client to perform normal tasks that are customary for the company or entity. But, the intermediate server is further equipped with a client licensing unit 128 to facilitate communication between the client 30 and license server 28. The intermediate server 32 also has a legacy license store 130, which stores licenses for clients whose platforms cannot generate a unique system ID.

The client 30 has a license requestor 132, a challenge handler 134, and a license cache 136. The license requestor 132 initiates the license requests for obtaining a software license from the license server 28. This involves connecting to the intermediate server 32 and presenting a software license and a client ID to

the intermediate server 32. The client ID submitted by the client is validated against the client ID within the license. To prevent a client from simply looking within a license to find its associated client ID, the license server encrypts the software license with a key that is never disclosed to clients and hence the client is incapable of decrypting the software license. Furthermore, license tampering is prevented by digitally signing the software licenses when the license server issues them.

The client ID is passed onto the license server 28, which then initiates a platform challenge. The client's challenge handler 134 handles the platform challenge from the license server 28. It computes a response to the challenge that contains the client's image, which can be used by the license server 28 to authenticate the client.

If the client is deemed authentic, the license server downloads a software license to the client. The license server 28 encrypts the license using the client's public key and digitally signs the license. Additionally, the license generator assigns a unique license ID to the issued license. Because the licenses are tied to a specific client through a client ID, digitally signed by the license server and encrypted, the software licenses cannot be activated on other clients.

The license requestor 132 verifies the signature on the license to confirm that it came from the license server 28 and stores the software license in the license cache 136. It is the responsibility of the license requestor 132 to manage the licenses stored in the cache 136. The licenses are organized in the license cache 136 according to information about the license issuing authority and product ID.

The license cache 136 is kept in persistent (non-volatile) storage. Clients that do not have persistent storage can be issued licenses as long as they can

generate a unique client ID and can respond to the client platform challenge protocol. The licensing system handles this case in the same way it recovers lost licenses. On connect, the intermediate server contacts the license server for a new license. The license server realizes, through the system ID, that the license has already been issued. In this case, the old license is simply returned to the client. Clients that cannot generate a system ID or respond to the platform challenge protocol use the legacy licenses stored in the legacy license store 130 at the intermediate server 32.

The license requestor 132 and the challenge handler 134 are preferably implemented in software executing on the client 30. These software programs are preferably implemented as part of the client's operating system.

It is noted that Fig. 3 illustrates one possible implementation of the software licensing system 20. Other implementations are possible. As one example, the components associated with a client platform challenge may be removed. These components include the client image installer 118, the client image cache 120, and the client authenticating module 124 in the license server 28, and the challenge handler 134 in the client 30.

System IDs

One aspect of system 20 is the ability to generate unique identifiers for the servers and clients. These unique IDs include the license server ID in license server certificate 140 and the client's system ID 142 (collectively referred to as "System IDs"). The system 20 employs a per-seat licensing technique, in which licenses are associated with a particular client or machine (i.e., "seat" or "node"). The license server certificate 140 contains a unique ID for the license server 28,

which is passed to the license generator during a request for a license pack. The client's system ID 142 is a unique identifier of the client computer. It is noted that the client ID assigned by the license server to a software license may be client's system ID, although it will typically be a separate identifier created by the license server solely for tracking purposes.

As one possible implementation, the system IDs can be based on information collected form a computer's hardware and installed software. For example, hard disk volume numbers, network cards, registered software, video cards, and some microprocessors contain unique identifiers. On PCs, this information can be combined to uniquely identify a particular PC. Other information that might be used includes total RAM and floppy disk drive configuration. Because these components can be removed or replaced, thus changing the system ID, procedures for accepting system IDs allow for some variations. For instance, the procedures might allow for a few parameters to vary.

However, relying on a machine's hardware characteristics may not always be sufficient when generating unique machine IDs. For example, the hardware characteristics of some computers may not vary, so they would all generate the same machine ID. In these cases, manufacturers "brand" the computers with a unique identifier that it can be used to generate a unique machine ID. Client platforms that cannot generate a unique machine ID are still permitted to connect to an intermediate server and are deemed legacy platforms. Legacy licenses maintained in the legacy license store 130 are used for these machines.

Issuance of License Pack

Fig. 4 shows steps in a method for requesting and issuing a license pack from a license generator. At step 150, the license server 28 generates and sends a purchase request 106 to an authorized license generator 26. The request 106 contains information used by the license generator 26 to issue one or more software license packs to the requesting license server 28. The purchase request 106 contains the platform type (see Table 2), the quantity of licenses desired, the product ID, the license server's certificate (containing the license server's public key K_{LS_pub} and the license server ID), and the list of features that the license should enable. The license server can submit this information electronically to the license generator via the Internet, modem, e-mail, on a floppy diskette, or other electronic means. Additionally, the administrator at the company or entity might submit a purchase request to the licensing clearinghouse 22 in writing on paper, or place an order orally by telephone. The license server 28 typically submits a licensing fee with the purchase request, or sometime following the initial communication.

After collecting the fee for the software licenses, the license generator 26 creates a license pack containing a set of one or more individual software licenses and assigns a unique license pack ID to the license pack (step 152 in Fig. 4). The license generator 26 stores the collected information in the master license database 100 (step 154). The information from the license server 28 is correlated within the database 100 to the license pack ID. In this manner, the license pack ID is associated with a particular license server having a specific license server ID (step 156).

The license generator 26 encrypts the license pack of software licenses using the license server's public key K_{LS_pub}, thus binding the license pack to the requesting license server 28. The license generator 26 digitally signs the license pack using its (i.e., the clearinghouse's) private signing key K_{CH_pri} (step 160 in Fig. 4) and sends the license pack to the requesting license server 28.

The license pack 108 contains a set of one or more non-assigned licenses and the license pack ID. Table 1 lists the contents of the license pack 108.

At step 164 in Fig. 4, the license server 28 uses the clearinghouse's public signing key K_{CH_pub} to verify that the digital signature accompanying the license pack 108 belongs to the license generator 26 of clearinghouse 22 and that the license pack 108 has not been altered. If the signature is authentic and from a known clearinghouse, the license server 28 decrypts the license pack contents using its private key K_{LS_pri} (step 166). The license server 28 extracts the license pack ID and queries the secure license store 112 to see if it already contains the same license pack (step 168). If the license pack is new, the license server installs it on the secure license store 112 (step 170).

Distribution of Licenses

Client Connection

Fig. 5 shows steps in a process that facilitates a client's initial connection to the intermediate server. The client connects to the intermediate server 32 to ask for services or data provided by the server. Prior to working with the client and providing access to files, the intermediate server 32 wants to verify first that the client has a valid software license issued by a recognized license server. The client 30 may or may not have a valid license, so the intermediate server makes an initial

evaluation when the client attempts to connect. Generally, if the client 30 has a valid license, the client is permitted to connect and use the server's resources. If the client 30 offers an invalid license, the client is disconnected. If the client 30 does not offer a valid license or offers an expired license, the intermediate server 32 facilitates the process of obtaining a new software license.

At step 172, the client 30 submits a connection request to the intermediate server 32. The connection request includes the client's system ID that uniquely identifies the computer. In response, the intermediate server 32 passes a list of the product IDs required (step 174). In this manner, the intermediate server 32 limits its acceptance of software licenses to those that are issued by legitimate and authorized license servers.

With this information, the client 30 queries its license cache 136 to search for a suitable license from a license server that appears on the list (step 176 in Fig. 5). If a software license is found, the client 30 sends the software license to the intermediate server 32 along with the client ID; otherwise, the client 30 submits only a client ID (step 178). The software license contains the digital signature of the license server.

At step 180 in Fig. 5, the intermediate server 32 determines whether the client submitted a software license. If so, the intermediate server 32 verifies whether the digital signature belongs to an authorized license server and whether the license contains a valid client ID (step 182). The client ID is checked by extracting the client ID from the license (which was provided originally by the licensing server, as described below) and comparing it to the client ID received from the client. If the two match, the client ID passes.

If the digital signature or the client ID is not valid (i.e., the "not valid" branch from step 182), the software license is deemed invalid. The client's request for connection is then rejected and the client is disconnected. On the other hand, if the digital signature and the client ID are both valid (i.e., the "valid" branch from step 182), the intermediate server 32 checks if the license has expired (step 184), the connection is completed if the license is still valid i.e. has not expired and the client is allowed access to the services and files of the intermediate server (step 186).

In the event that the client 30 does not submit a valid license or submits an expired license, the intermediate server requests a new software license from the license server (step 188 in Fig. 5).

New License Grant

Software licenses are distributed to the client automatically by the license server. As discussed above, when a client 30 connects to an intermediate server 32, the client must present a valid license. If it cannot, the intermediate server acts as a proxy for the client and requests a license from its associated license server.

Fig. 6 shows steps in a method for granting a new software license from the license server 28 to the client 30. The method begins with step 188, which is the same new license request discussed above with respect to step 188 of Fig. 5. The new license request includes the client's system ID and the product ID. In response to the request, the license server 28 initiates a client challenge to determine who the client is and what platform it is running (step 190). In general, this involves generating a challenge and sending it to the intermediate server 32

(step 192). The intermediate server 32 forwards the challenge to the client 30 (step 194).

At step 196 in Fig. 6, the client responds to the challenge in a manner that provides trusted information about client, including the platform type and the client's public key. The response is passed to the intermediate server 32, which forwards it to the license server 28 (step 198).

At step 200 in Fig. 6, the license server determines whether the response is proper, and hence, whether the client is authentic. If the client is authenticated (i.e., the "yes" branch from step 200), the license server proceeds with granting a software license. The license server 28 first queries the secure license store 112 to determine if a license for that client has already been issued (step 202). This procedure accommodates the case in which the client has lost its valid software license. If a non-expired license is found, the license server 28 forwards it to the client 30.

Otherwise, the license server 28 attempts to allocate a software license for the client, assuming a non-assigned license still exists in the license pack. If a license can be allocated, the license server 28 retrieves a software license that is appropriate for the client's platform from the secure software store 112 and grants the software license to the client (step 204 in Fig. 6). The license server 28 adds a record to the client assignment table 116 and the corresponding number assigned field is updated to reflect one additional allocation.

To prevent the software license from being copied from one client machine to another, the software license is assigned to the specific client by including its client ID within the license. The software license also has a corresponding license ID that is associated with the client ID in a the client assignment table 116 in the

secure license store 112 at the license server. The contents of the license are described above in Table 5.

The license server 32 digitally signs the software license (step 206) and encrypts it using the client's public key K_{C_pub} (step 208), thereby binding the license to the client. The encrypted license is forwarded to the intermediate server 32, which passes it on to the client 30 and completes the connection (step 210). By encrypting the license, the client or the license server need not trust the intermediate server because the intermediate server cannot maliciously utilize or modify the encrypted license. It also removes the risk of a rogue server masquerading as intermediate server. At step 212, the client 30 decrypts the license using the client's private key K_{C_pri} and stores the license in the license cache 136.

In the event that the client's response to the challenge is deemed improper (i.e., the "no" branch from step 200), the license server returns a rejection notice (step 214 in Fig. 6). This rejection notice is passed on by the intermediate server 32 (step 216) and used to inform the user (step 218).

Platform Challenge

Fig. 7 shows a more detailed method for providing a platform challenge to the client. In this illustration, the intermediate server 32 is shown as the go between, with the forwarding steps omitted for ease of description.

An aspect of platform validation is establishing the authenticity of the client. The system utilizes the client's executable image to generate a digital signature that uniquely identifies the client. As noted above, the client's executable image is available to the license server 28 because it is stored in the client image cache 120.

When a client requests a software license from the license server, the client 30 submits a client software ID (step 220 in Fig. 7). The software ID is assigned by the software manufacturer/vendor to be unique for each client release. The client software ID is a bit field that contains a platform identifier, a vendor identifier, and a client revision field. The arrangement of the bits depends on how many platforms and clients are supported.

At step 222, the license server 28 uses the software ID to lookup the client's executable image in the client image cache 120. If the image is not present in the cache (i.e., the "no" branch from step 222), the client is denied a software license and a rejection is returned to the client and informs the user (steps 224 and 226).

On the other hand, if an image is present (i.e., the "yes" branch from step 222), the license server 28 sends a challenge to the client 30 to establish a trust relationship with the client (step 228). The challenge is preferably a 128-bit random number.

The client 30 applies a one-way function to a combination of the challenge and the client's image (step 230). Preferably, the client concatenates the challenge and the client image and computes a hash value, as follows:

Challenge Response = Hash(challenge|client image|challenge)

The client 30 sends the challenge response (i.e., the hash value) back to the license server 28 (step 232).

Meanwhile, the license server 28 uses the software ID to retrieve a reference copy of the client image from its cache 120 (step 234 in Fig. 7). The license server then computes a test hash value using the same hash function, and a

concatenated version of the same 128-bit challenge and the client image retrieved from the cache 120 (step 236).

The license server 28 compares the test hash value (H') with the hash value (H) returned from the client (step 238). If the two values are the same, the client's platform information is extracted from the client software ID and a trust relationship established (i.e., the "yes" branch from step 238). Otherwise, the client is denied a software license and a rejection is returned to the client (i.e., the "no" branch from step 238).

Upgrading Licenses

The process for upgrading an existing license is very similar to the license distribution process. The primary difference is that a platform challenge is not performed because a valid, digitally signed license is presented to the license server.

Fig. 8 shows the steps in a method for upgrading an existing license. Steps 172-176 are identical to those defined above with respect to Fig. 5. At step 240, the client 30 submits a valid software license to the intermediate server 32.

At step 242 in Fig. 8, the intermediate server 32 determines whether the license has expired and/or is for an older version. Assuming it meets one of these conditions, the intermediate server automatically contacts the license server 28 and requests that the license be upgraded (step 244). The intermediate server passes the old license and the client's system ID to the license server 28.

The license server 28 validates the old license and extracts the license's ID, which is used as an index into the client assignment table 116 in the secure license store 112. The license server 28 examines the table 116 to determine whether an

upgrade is available (step 246). If so, the license server 28 upgrades a record in the table, consuming one upgrade license, and returns an upgraded licese to the intermediate server 32 (step 248). The intermediate server 32 forwards the upgraded license to the client and completes the connection (step 250). The client 30 replaces the old license with the upgraded one in the license cache 136 (step 252).

As a matter of policy, licenses are assumed to be backward compatible. That is, a next generation 5.X license is always accepted by a current ganeration 4.X server. This allows a customer to have a seamless mix of different servers. Variances in the licenses internal data structures are taken into account by including a version number within the license.

Temporary Licenses

Suppose a client 30 requests a software license, but the license server 28 does not have an available license in the secure license store. In this case, the license server 28 issues a temporary license that is valid for a finite duration (e.g., 60 days).

With reference to Fig. 3, the requesting client submits its system ID 142 to the intermediate server 32, which forwards the client's system ID 142 to the license server 28. The license server 28 generates a temporary license and associates it with the client's system ID 142. The temporary license is passed back through the intermediate server 32 to the client 30. Each time the client presents the temporary license, a new license request is generated. Once the license server has an available license (e.g., the license server purchased additional licenses from

the license clearinghouse), it issues a permanent license to the client. Temporary licenses are replaced only by a valid permanent license.

When a temporary license expires, the license server 28 no longer accepts it and services are denied. Furthermore, the client is only granted one temporary license and will not be permitted to request a second temporary. If a client attempts to request a second temporary license, the license server will detect the system ID and recognize that this ID is already associated with a previously issued temporary license. The license server 28 simply returns the previously issued temporary license, which is inoperable because it has expired.

Although the invention has been described in language specific to structural features and/or methodological steps, it is to be understood that the invention defined in the appended claims is not necessarily limited to the specific features or steps described. Rather, the specific features and steps are disclosed as preferred forms of implementing the claimed invention.

CLAIMS

1. A computer-implemented method comprising the following steps:

creating a license pack at a license generator, the license pack containing a set of one or more individual software licenses;

signing the license pack with a digital signature of the license generator;

issuing the license pack to a license server;

verifying, at the license server, the license generator's digital signature on the license pack; and

distributing the software licenses contained in the license pack from the license server to corresponding clients.

2. A computer-implemented method as recited in claim 1, further comprising the step of creating a license pack containing a predefined number of software licenses.

3. A computer-implemented method as recited in claim 1, further comprising the following steps:

creating a license pack ID at the license generator; and

evaluating the license pack ID at the license server.

4. A computer-implemented method as recited in claim 1, further comprising the following steps:

encrypting the license pack at the license generator; and

decrypting the license pack at the license server.

5. A computer-implemented method as recited in claim 1, further comprising the step of creating a license pack that is tailored to a particular operating platform of the clients.

6. A computer-implemented method as recited in claim 1, further comprising the step of determining an authenticity of an individual client prior to distributing the software license to that individual client.

7. A computer-implemented method as recited in claim 1, further comprising the following steps:

determining whether an individual client has a non-expired license;

in the event that the client has a non-expired license, forwarding the non-expired license to the individual client; and

in the event that the client does not have a non-expired license, granting one of the software licenses from the license pack.

8. A computer-implemented method as recited in claim 7, further comprising the step of encrypting said one software license using a public key of the individual client.

9. A computer-implemented method as recited in claim 1, further comprising the step of evaluating whether an individual client already has a software license that has not yet expired.

10. A computer-implemented method as recited in claim 1, wherein the license pack has a license pack ID, and further comprising the step of granting additional licenses for the license pack having the same license pack ID.

11. A computer-implemented method as recited in claim 1, further comprising the following steps:

submitting an old software license from one of the clients to the license server, the old software license containing a license ID;

determining whether an upgrade software license is available for the license ID;

granting the upgrade software license if available to the one client; and

replacing, at the one client, the old software license with the upgrade software license.

12. A computer-implemented method as recited in claim 1, further comprising the step of distributing a temporary license of in an event that no more licenses are available from the license pack.

13. A computer-implemented method for distributing software licenses to clients so that the clients may legally execute underlying software to which the software licenses pertain, the computer-implemented method comprising the step of electronically issuing the software licenses as digital certificates that can be distributed in one-to-one correlation with individual clients and traced to an issuing authority.

14. A computer-readable medium having computer readable instructions for performing the step as recited in claim 13.

15. A computer-implemented method comprising the following steps:

receiving a request for a software license from a particular license server;

creating a license pack containing a set of one or more individual software licenses;

assigning a license pack ID to the license pack;

associating the license pack ID with the particular license server;

digitally signing the license pack; and

issuing the signed license pack to the particular license server.

16. A computer-implemented method as recited in claim 15, further comprising the step of creating a license pack containing a predefined number of software licenses.

17. A computer-implemented method as recited in claim 15, further comprising the step of creating a license pack that includes a platform type indicating a type of operating platform for which the software licenses can be used.

18. A computer-implemented method as recited in claim 15, further comprising the step of creating a license pack that includes a predefined number of software licenses, a platform type indicating a type of operating platform for which the software licenses can be used, an expiration date indicating a date on which the software licenses will expire, and a product ID that identifies a product with which the software licenses can be used.

19. A computer-implemented method as recited in claim 15, further comprising the step of encrypting the license pack.

20. A computer-readable medium having computer readable instructions for performing the steps as recited in claim 15.

21. A computer-implemented method comprising the following steps:

receiving a request for a software license from a particular client;

determining an authenticity of the particular client;

selecting a software license from a pack of software licenses that is appropriate for the particular client, the software license having an associated license ID;

associating the license ID with the particular client; and

granting the software license to the particular client.

22. A computer-implemented method as recited in claim 21, further comprising the step of determining whether the particular client already has a non-expired license, and if so, forwarding the non-expired license to the particular client rather than granting the software license.

23. A computer-implemented method as recited in claim 21, further comprising the step of granting the software license as containing the license ID, a platform type indicating a type the platform, an issue date indicates a date on which the license is issued to the client, an expiration date that indicates a date on which the software license will expire, a product ID that identifies a product with which the software licenses can be used, a client ID that identifies the particular client, and a version of the software license.

24. A computer-implemented method as recited in claim 21, wherein the step of determining the authenticity comprises the following steps:

receiving a client software ID from the particular client; and

evaluating the client software ID to determine whether the client is authentic.

25. A computer-implemented method as recited in claim 21, wherein the step of determining the authenticity comprises the following steps:

maintaining a set of client images;

receiving a client software ID from the particular client; and

comparing the client software ID to the client images to evaluate whether the client is authentic.

26. A computer-implemented method as recited in claim 21, further comprising the following steps:

determining a platform of the particular client; and

selecting the software license as is appropriate for the platform of the particular client.

27. A computer-implemented method as recited in claim 21, further comprising the step of encrypting the software license using a public key of the particular client.

28. A computer-implemented method as recited in claim 21, further comprising the step of granting a temporary software license that expires in a substantially shorter duration in comparison to the software license.

29. A computer-readable medium having computer readable instructions for performing the steps as recited in claim 21.

30. A computer-implemented method comprising the following steps:

computing a value as a one-way function of a client executable image that uniquely identifies a client; and

digitally signing the value using a private signing key of a server that serves the client to create a client image digital signature that is unique to the client.

31. A computer-implemented method as recited in claim 30, wherein the computing step comprises the step of hashing the executable image to produce a hash value.

32. A computer-implemented method as recited in claim 30, further comprising the step of storing the client image digital signature at the client.

33. A computer-implemented method as recited in claim 30, further comprising the following steps:

storing the client executable image at the server;

storing the client image digital signature at the client;

submitting the client image digital signature from the client to the server when requesting a software license; and

evaluating an authenticity of the client based on the client image digital signature prior to granting a software license to the client

34. A computer-implemented method as recited in claim 33, wherein the evaluating step comprises the following steps:

unsigning the client image digital signature using a public key of the server to recover the client executable image; and

comparing the recovered client executable image to the client executable image stored at the server.

35. A computer-implemented method as recited in claim 34, further comprising the step of rejecting the request for a software license in an event that the recovered client executable image does not match the client executable image stored at the server.

36. A computer-readable medium having computer readable instructions for performing the steps as recited in claim 30.

37. A computer-implemented method comprising the following steps:

receiving a request for a software license from a client having a valid client image;

submitting a challenge to the client, the challenge comprising a random number;

computing, at the client, a function of the challenge and the client image to produce a response;

returning the response to the server;

deriving the client image from the response at the server; and

verifying the client image at the server prior to granting the software license.

38. A computer-implemented method as recited in claim 37, wherein the computing step comprises the following steps:

concatenating the random number and the client image to produce a concatenated value; and

computing a hash function of the concatenated value.

39. A computer-implemented method as recited in claim 37, further comprising the step of rejecting the request for the software license in the event that the client image cannot be verified.

40. A computer-implemented method as recited in claim 37, further comprising the step of establishing a trust with the client and subsequently granting the software license in the event that the client image can be verified.

41. Computer-readable media distributed at the server and the client having computer readable instructions for performing the steps as recited in claim 37.

42. A computer-implemented method comprising the following steps:

submitting an old software license from a client to a server, the old software license containing a license ID;

determining whether an upgrade software license is available for the license ID;

granting the upgrade software license, if available, to the client; and

replacing, at the client, the old software license with the upgrade software license.

43. A computer-implemented method as recited in claim 42, further comprising the step of tracking at the server that the upgrade software license is granted to the client.

44. Computer-readable media distributed at the server and the client having computer readable instructions for performing the steps as recited in claim 42.

45. A system for licensing software, comprising:

a license generator to create a license pack containing a set of one or more individual software licenses, the license generator digitally signing the license pack with a digital signature; and

a license server remote from, but operatively coupled to, the license generator to receive the license pack from the license generator, the license server verifying the license generator's digital signature on the license pack and storing the individual licenses for subsequent distribution to individual clients.

46. A system as recited in claim 45, wherein the license generator assigns a license pack ID to the license pack and associates the license pack ID with the license server.

47. A system as recited in claim 45, wherein the license generator encrypts the license pack using a public key of the license server.

48. A system as recited in claim 45, wherein the license pack contains a preset number of software licenses.

49. A system as recited in claim 45, wherein the license pack identifies a type of operating platform for which the software licenses can be used.

50. A system as recited in claim 45, wherein the license pack comprises at least one of the following items:

a predefined number of software licenses;

a platform type indicating a type of operating platform for which the software licenses can be used

an expiration date that indicates a date on which the software licenses will expire; and

a product ID that identifies a product with which the software licenses can be used.

51. A system as recited in claim 45, wherein the license server selects a software license from the license pack and grants the software license to a client, the software license having a license ID and the license server associating the license ID with the client.

52. A system as recited in claim 45, wherein the license server challenges an authenticity of a client prior to granting a software license from the license pack to the client.

53. A system as recited in claim 45, wherein the license server grants a software license server to a particular client, the license server encrypting the software license using a public key of the particular client.

54. A system as recited in claim 45, wherein the license server distributes the software licenses to the individual clients via one or more intermediate servers.

55. A license generator for issuing packs of software licenses to authorized license servers, comprising:

a request handler to receive a request from a license server for a license pack;

a license producer responsive to the request received by the request handler to generate a license pack containing a set of one or more individual software licenses; and

the license producer assigning a license pack ID to the license pack, associating the license pack ID with the license server, and digitally signing the license pack.

56. A license generator as recited in claim 55, wherein the license pack contains a predefined number of software licenses, a platform type indicating a type of operating platform for which the software licenses can be used, an expiration date that indicates a date on which the software licenses will expire, and a product ID that identifies a product with which the software licenses can be used.

57. A license generator as recited in claim 55, wherein the license producer encrypts the license pack using a public key of the license server.

58. A license generator as recited in claim 55, further comprising a master license database, the license producer storing the license pack ID in correlation with an ID of the license server in the master license database.

59. A program embodied on a computer-readable medium, comprising:

a code segment to create a license pack containing a set of one or more individual software licenses;

a code segment to assign a license pack ID to the license pack;

a code segment to associate the license pack ID with the particular license server; and

a code segment to digitally sign the license pack.

60. A license server for issuing individual software licenses from a software pack received from a licensing clearinghouse, comprising:

a license store to store the software pack of individual software licenses, each software license having an associated license ID;

a request handler to receive a request for a software license from a client;

a client authenticating module to determine whether the client is authentic and can receive a software license; and

a granting module to grant a software license from the license store to an authenticated client and to associate the license ID with the authenticated client.

61. A license server as recited in claim 60, wherein the authenticating module determines an operating platform of the client.

62. A license server as recited in claim 60, further comprising:

a client image cache to store a set of client images; and

the client authenticating module receives a client image from the client and compares the received client image to the set of client images to evaluate whether the client is authentic.

63. A license server as recited in claim 60, wherein the granting module encrypts the software license using a public key of the authenticated client.

64. A license server as recited in claim 60, wherein the software license contains at least one of the following items:

a version indicator of a software license;

a license ID;

a client ID that identifies the authenticated client;

an issue date on which the license is issued to the client;

a platform type of the client's operating platform for which the software license can be used;

an expiration date on which the software license will expire; and

a product ID that identifies a product with which the software licenses can be used.

65. A license server as recited in claim 60, further comprising a license pack table to store information pertaining to the license pack that is stored in the license store.

66. A license server as recited in claim 60, further comprising a client assignment table containing a list of the software licenses that are granted to clients.

67. A license server as recited in claim 66, wherein the granting module upgrades the client assignment table after granting the software license to the authenticated client.

68. A program embodied on a computer-readable medium, comprising:

a code segment to receive a license pack from a license generator, the license pack containing a set of one or more individual software licenses;

a code segment to validate the license pack;

a code segment to store the software licenses;

a code segment, responsive to a request for a software license from a client, to determine whether the client is authentic and can receive a software license;

a code segment to grant a software license to an authenticated client, the software license containing a license ID; and

a code segment to associate the license ID with the authenticated client.

69. A client computer, comprising:

a license cache to store one or more software licenses;

a license requestor to request a software license from a license server;

a challenge handler to handle an authenticity challenge from the license server, the challenge handler computing a challenge response that contains a client image that can be used by the license server to evaluate whether the client is authentic and can be licensed; and

whereupon authentication by the license server and granting of a software license, the license requestor receiving the software license from the license server and storing the software license in the license cache.

70. A client computer as recited in claim 69, wherein the challenge contains a random number, and the challenger handler computes the challenge response by concatenating the random number with the client image to form a concatenated value and hashing the concatenated value.

71. A program embodied on a computer-readable medium, comprising:

a code segment to receive an authenticity challenge from a license server that distributes software licenses;

a code segment to compute a challenge response that contains a client image that can be used by the license server to evaluate whether the client is authentic and can be licensed; and

a code segment to store the software license granted by the license server in an event that the client is deemed authentic.

72. A data structure embodied on a computer-readable media, comprising:

a license pack table to record information pertaining to one or more license packs, the license pack table being indexed by license pack IDs that identify corresponding individual license packs, each license pack containing one or more software licenses;

a client assignment table to record information pertaining to software licenses that are assigned to clients, the client assignment table being indexed by license IDs that identify individual software licenses, the client assignment table further having the license pack IDs of the license packs from which the corresponding software licenses are issued; and

the license pack table and the client assignment table being correlated via the license pack IDs contained in each table.

73. A data structure as recited in claim 72, wherein the license pack table contains the following table fields:

a license pack ID field to hold the license pack ID;

a quantity field to hold a number representative of how many software licenses are contained in the license pack;

a platform type field to hold a type of operating platform for which the software licenses in the license pack can be used;

an expiration date field to hold a date on which the software licenses in the license pack will expire; and

a product ID field to hold a product ID that identifies a product with which the software licenses in the license pack can be used.

74. A data structure as recited in claim 73, wherein the license pack table also contains a number assigned field to hold a number representative of how many of the software licenses have been assigned to clients.

75. A data structure as recited in claim 72, wherein the client assignment table contains the following table fields:

a license ID field to hold the license ID;

a license pack ID field to hold the license pack ID;

a client ID to hold an identifier of a client to which the software license is granted; and

an issue date to hold a date on which the software license is issued to the client.

76. A license pack data structure embodied on a computer-readable media comprising:

a license pack ID field to hold an identifier for an associated license pack that contains software licenses to be individually granted to individual computers;

a quantity field to hold a number representative of how many software licenses are contained in the license pack;

a begin serial number to hold a beginning serial number of the software licenses contained in the license pack;

an expiration date field to hold a date on which the software licenses will expire; and

a product data field to hold data regarding the product with which the software licenses can be used.

77. A license data structure embodied on a computer-readable media comprising:

a version field to hold a version indicator of a software license;

a license ID field to hold an identifier for the software license;

a client ID to hold an identifier of a client to which the software license is granted;

an issue date to hold a date on which the license is issued to the client;

an expiration date field to hold a date on which the software license will expire; and

a product data field to hold data regarding the product with which the software licenses can be used.

78. A license data structure as recited in claim 77, further comprising a description field to hold a written description of the software license.

ABSTRACT

A software licensing system includes a license generator located at a licensing clearinghouse and at least one license server and multiple clients located at a company or entity. When a company wants a software license, it sends a purchase request (and appropriate fee) to the licensing clearinghouse. The license generator at the clearinghouse creates a license pack containing a set of one or more individual software licenses. To prevent the license pack from being copied and installed on multiple license servers, the license generator assigns a unique license pack ID to the license pack and associates the license pack ID with the particular license server in a master license database kept at the licensing clearinghouse. The license generator digitally signs the license pack and encrypts it with the license server's public key. The license server is responsible for distributing the software licenses from the license pack to individual clients. When a client needs a license, the license server determines the client's operating system platform and grants the appropriate license. To prevent an issued license from being copied from one client machine to another, the software license is assigned to a specific client by including a client ID within the license. The software license also has a license ID that is associated with the client ID in a database record kept at the license server. The license server digitally signs the software license and encrypts it using the client's public key. The license is stored locally at the client.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Group Art Unit .....Not Assigned Yet
Examiner .....Not Assigned Yet
Attorney's Docket No. MS1-197USC1
Title: System and Method for Software Licensing

REQUEST TO APPROVE DRAWING CHANGES

To: Commissioner of Patents and Trademarks,
Washington, D.C. 20231

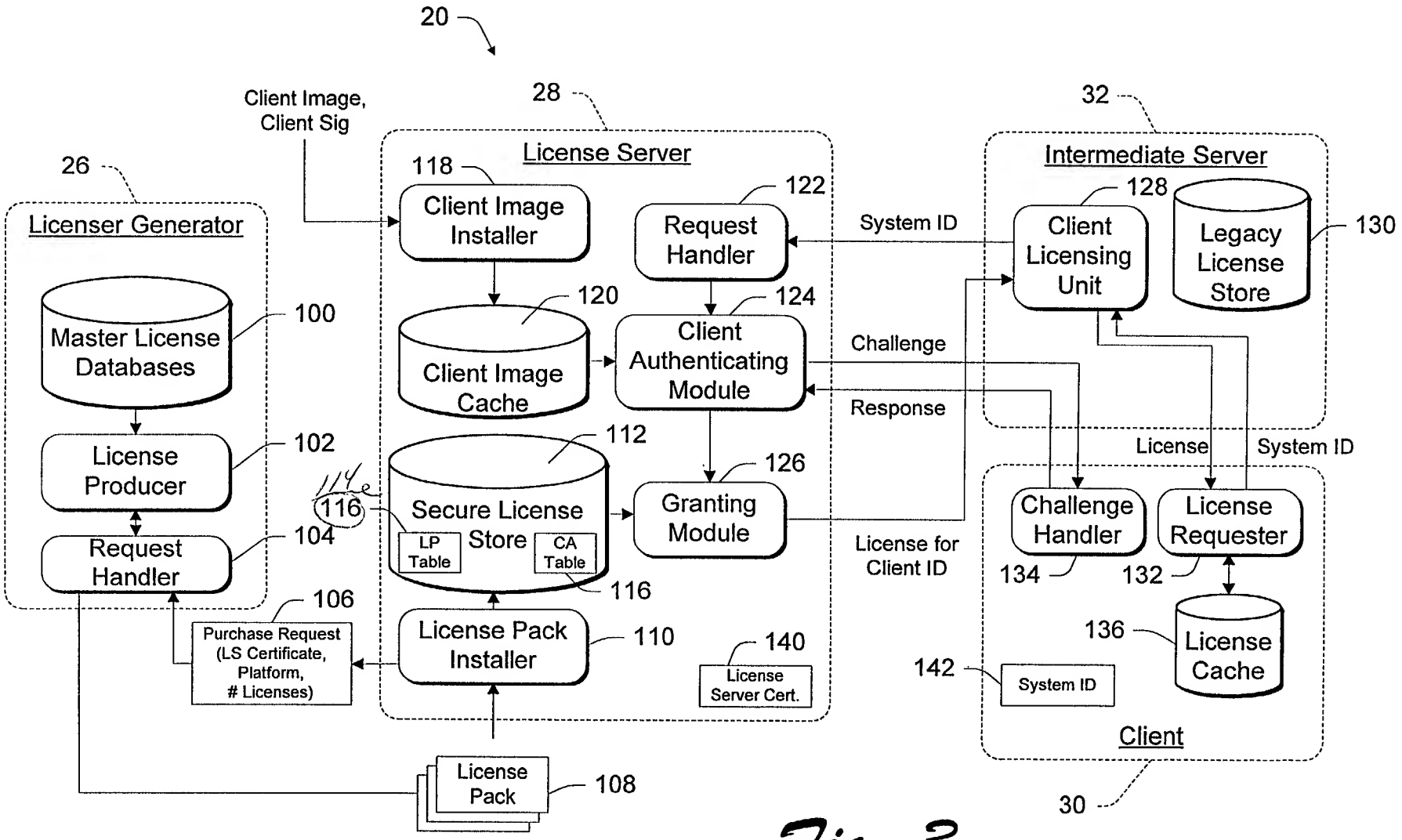
From: Allan T. Sponseller (Tel. 509-324-9256; Fax 509-323-8979)
Lee & Hayes, PLLC
421 W. Riverside Ave., Suite 500
Spokane, WA 99201

Enclosed is a photocopy of Fig. 3 of the drawings with proposed changes indicated in red. Support for the changes to the drawings can be found, for example, in the disclosure at page 17, lines 9-13. Applicant respectfully requests that the proposed changes in Fig. 3 be approved by the Examiner.

Respectfully Submitted,

Date: 11/28/00

By: _____
Allan ~~T.~~ Sponseller
Reg. No. 38,318
(509) 324-9256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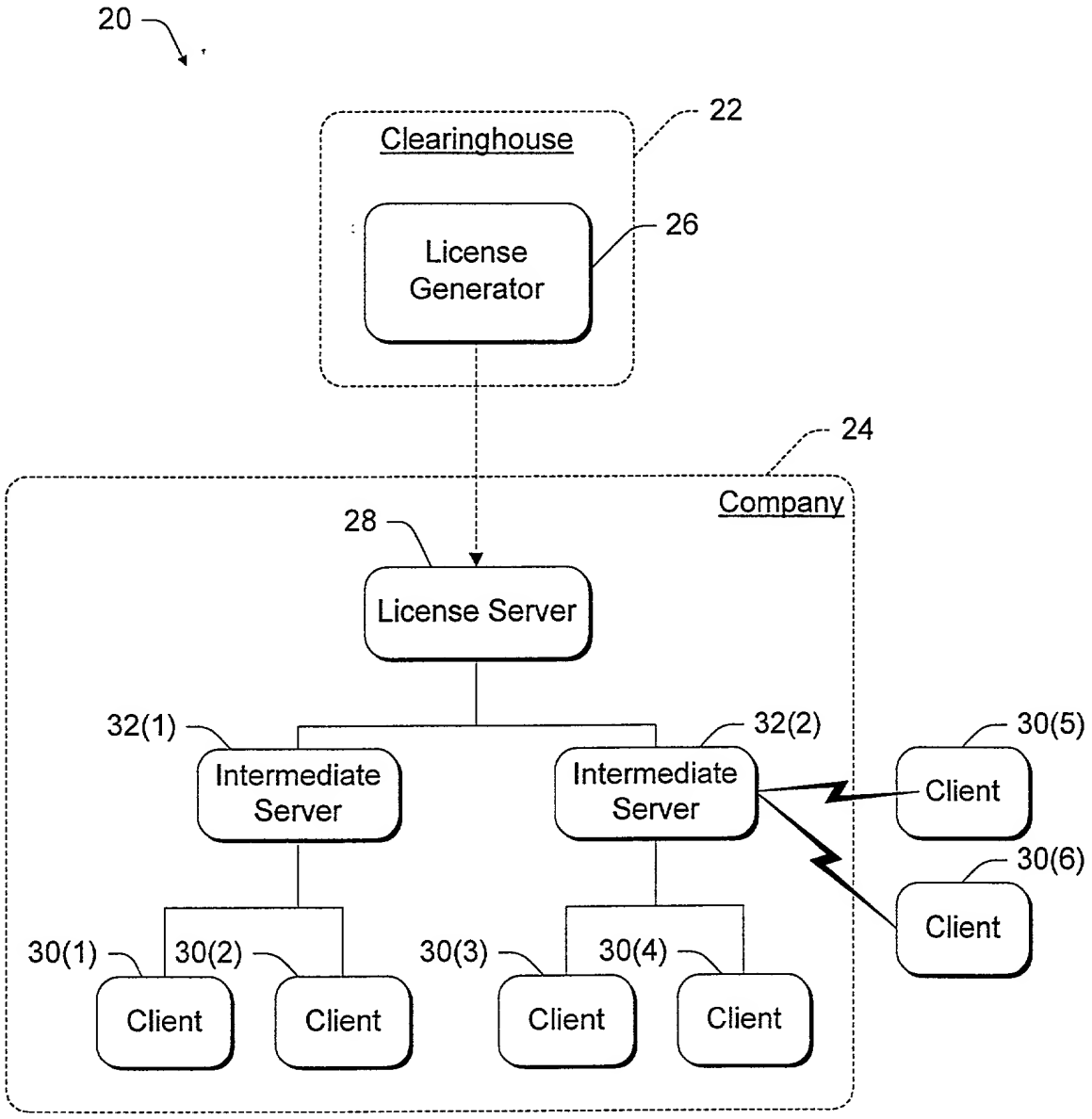
Client Image, Client Sig
28
License Server
32
Intermediate Server
26
Licenser Generator
118
Client Image Installer
122
Request Handler
System ID
128
Client Licensing Unit
Legacy License Store
130
Master License Databases
100
120
Client Image Cache
124
Client Authenticating Module
Challenge
Response
License
System ID
License Producer
102
112
114e
116
Secure License Store
LP Table
CA Table
126
Granting Module
License for Client ID
Challenge Handler
License Requester
134
132
Request Handler
104
106
Purchase Request (LS Certificate, Platform, # Licenses)
License Pack Installer
110
140
License Server Cert.
136
License Cache
142
System ID
Client
30
License Pack
108

Fig. 3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Clearinghouse
22
License Generator
26
24
Company
28
License Server
32(1)
Intermediate Server
32(2)
Intermediate Server
30(5)
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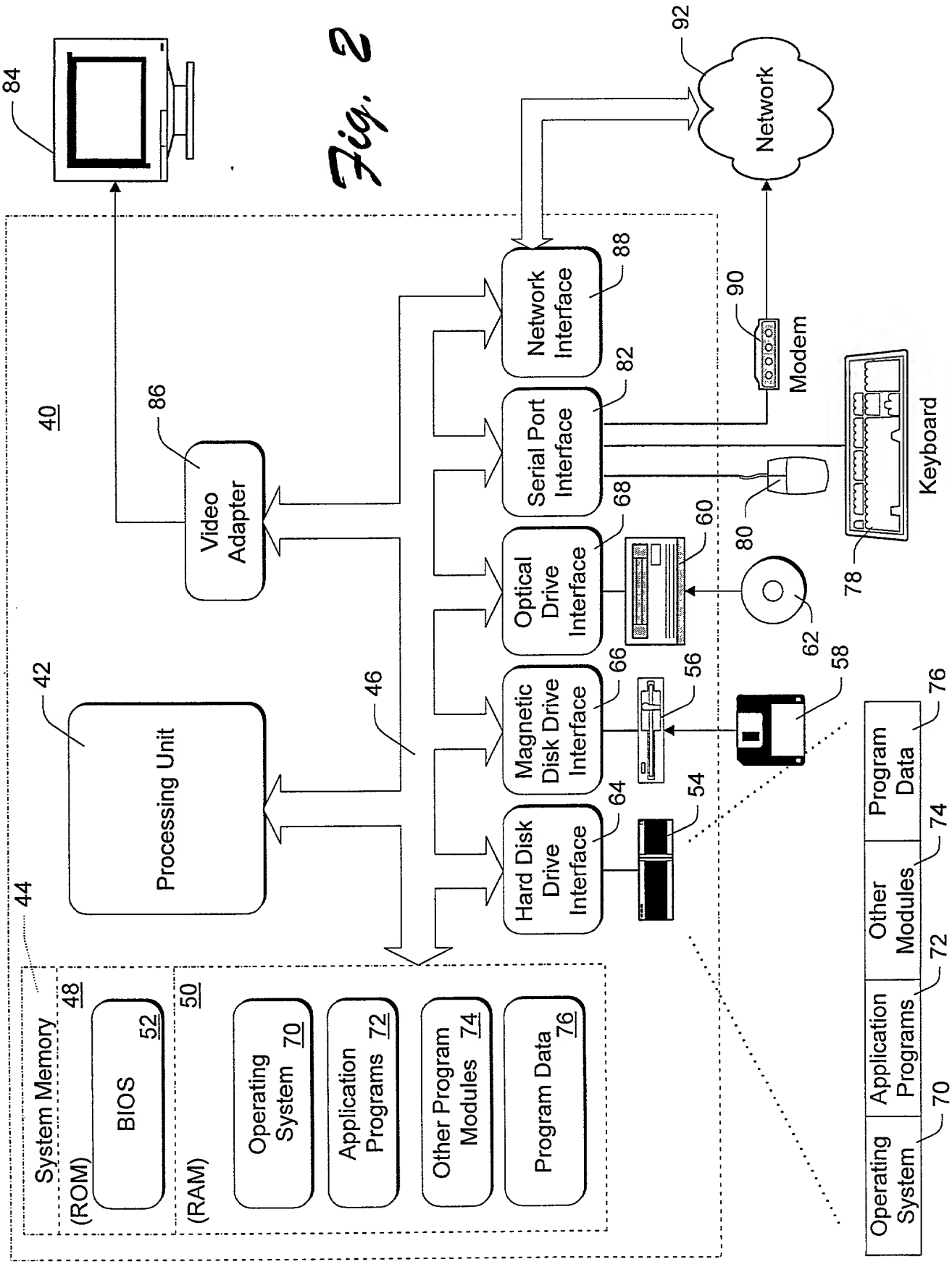
Client
30(1)
Client
30(2)
Client
30(3)
Client
30(4)
Client

Fig. 1


84
92
Network
Fig. 2
40
86
Video Adapter
Network Interface
88
90
Modem
Serial Port Interface
82
Keyboard
68
60
80
Optical Drive Interface
78
62
42
Processing Unit
46
66
56
Magnetic Disk Drive Interface
58
64
54
Hard Disk Drive Interface
76
Program Data
74
Other Modules
72
Application Programs
70
Operating System
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System Memory
48
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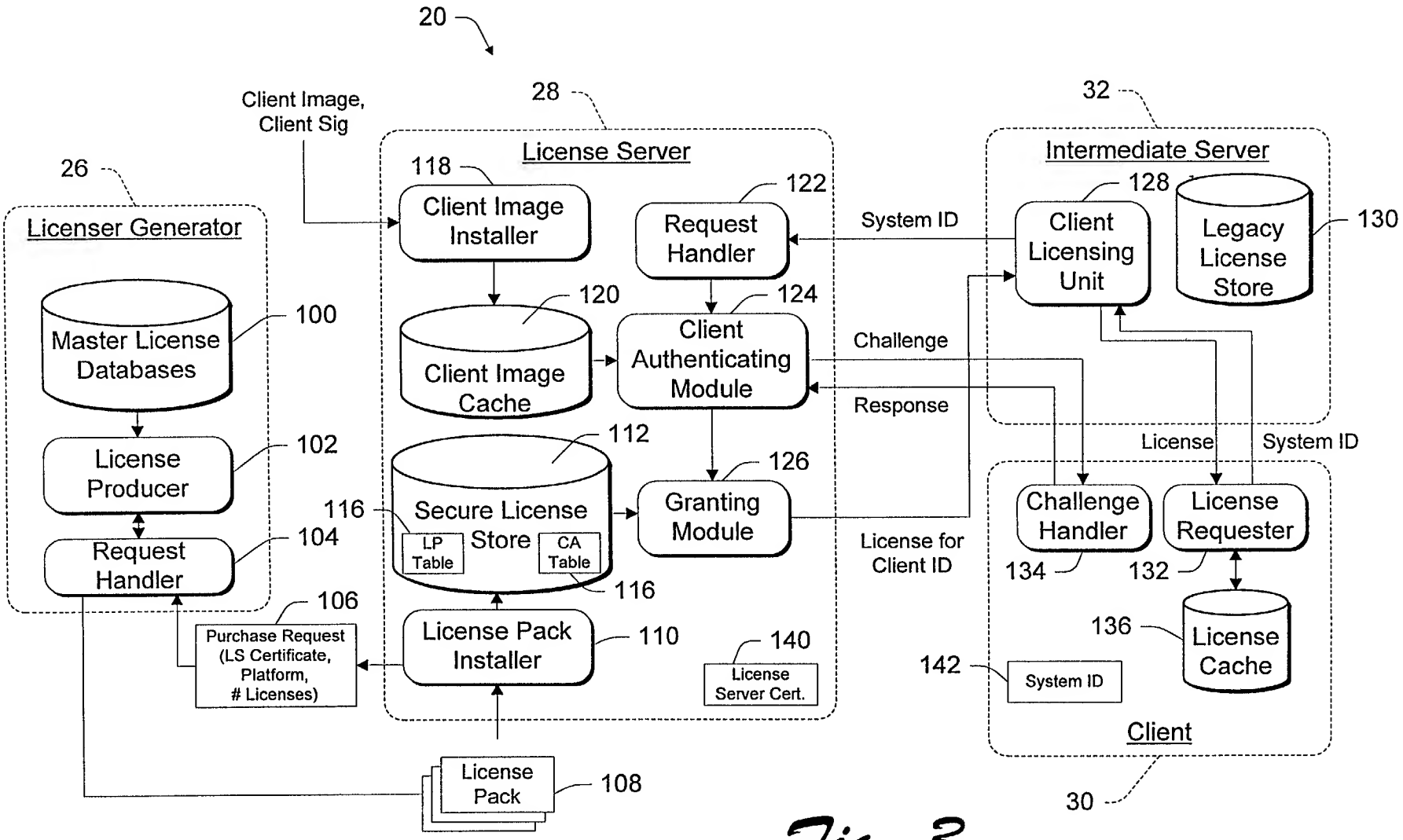
BIOS
52
50
(RAM)
Operating System 70
Application Programs 72
Other Program Modules 74
Program Data 76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Client Image, Client Sig
28
License Server
32
Intermediate Server
26
Licenser Generator
118
Client Image Installer
122
Request Handler
System ID
128
Client Licensing Unit
Legacy License Store
130
Master License Databases
100
120
Client Image Cache
124
Client Authenticating Module
Challenge
Response
License
System ID
License Producer
102
112
126
Secure License Store
LP Table
CA Table
116
Granting Module
Challenge Handler
License Requester
Request Handler
104
116
License for Client ID
134
132
106
Purchase Request (LS Certificate, Platform, # Licenses)
License Pack Installer
110
140
License Server Cert.
136
License Cache
142
System ID
Client
License Pack
108
30

Fig. 3

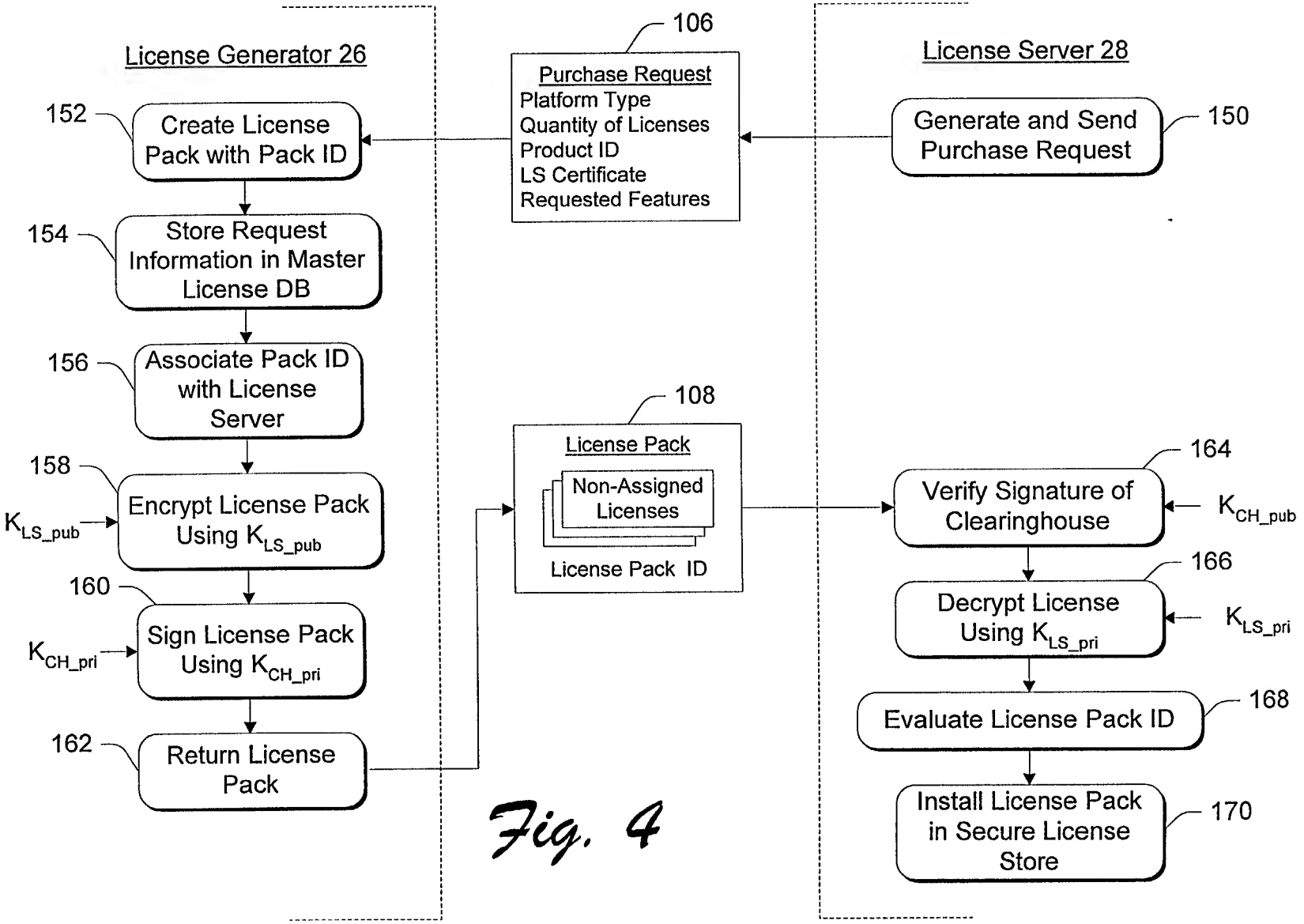
License Generator 26
License Server 28
106
Purchase Request
Platform Type
Quantity of Licenses
Product ID
LS Certificate
Requested Features
152
Create License Pack with Pack ID
154
Store Request Information in Master License DB
156
Associate Pack ID with License Server
158
K_{LS_pub}
Encrypt License Pack Using K_{LS_pub}
160
K_{CH_pri}
Sign License Pack Using K_{CH_pri}
162
Return License Pack
108
License Pack
Non-Assigned Licenses
License Pack ID
150
Generate and Send Purchase Request
164
Verify Signature of Clearinghouse
K_{CH_pub}
166
Decrypt License Using K_{LS_pri}
K_{LS_pri}
168
Evaluate License Pack ID
170
Install License Pack in Secure License Store

Fig. 4

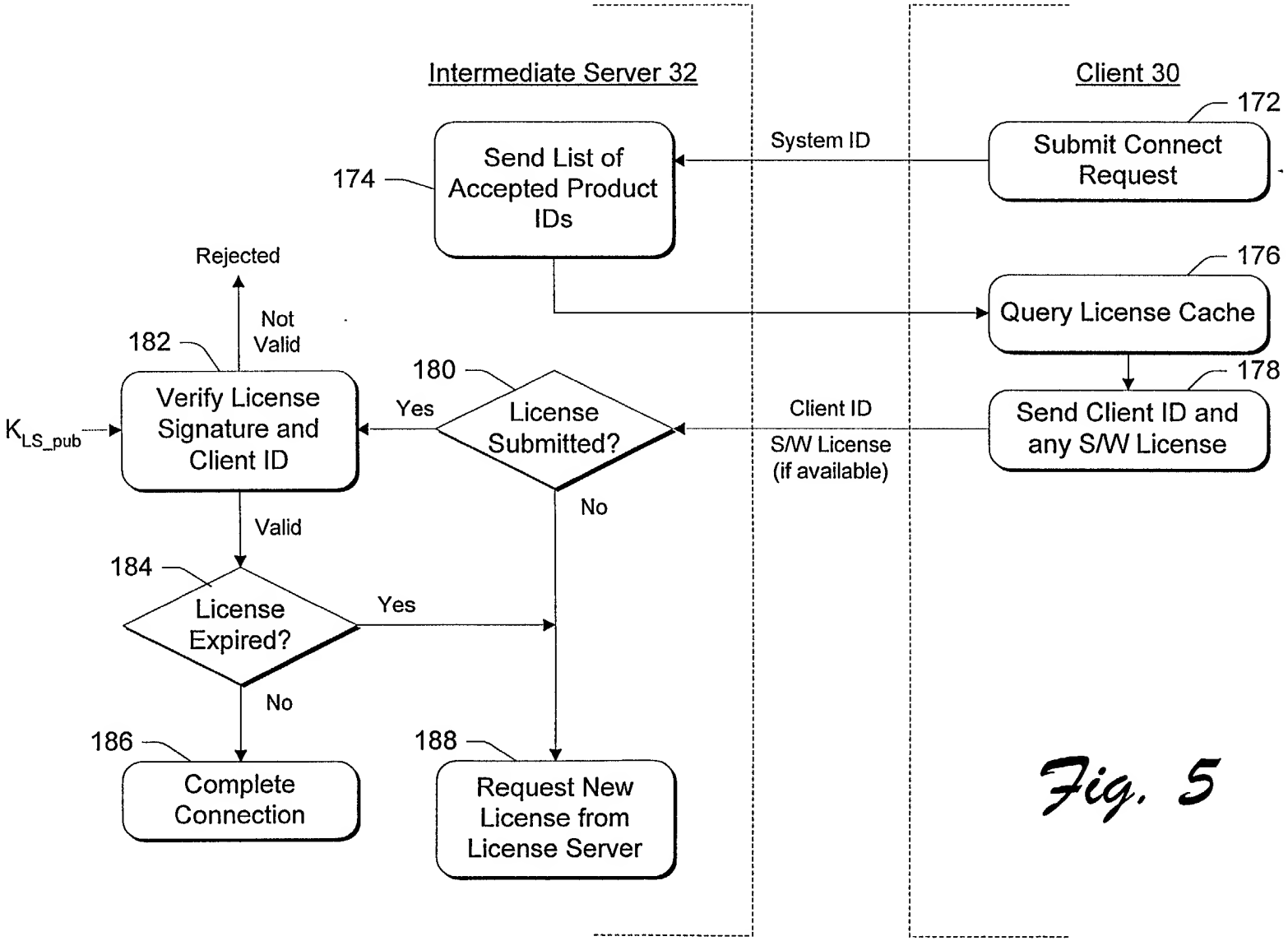

Fig. 5

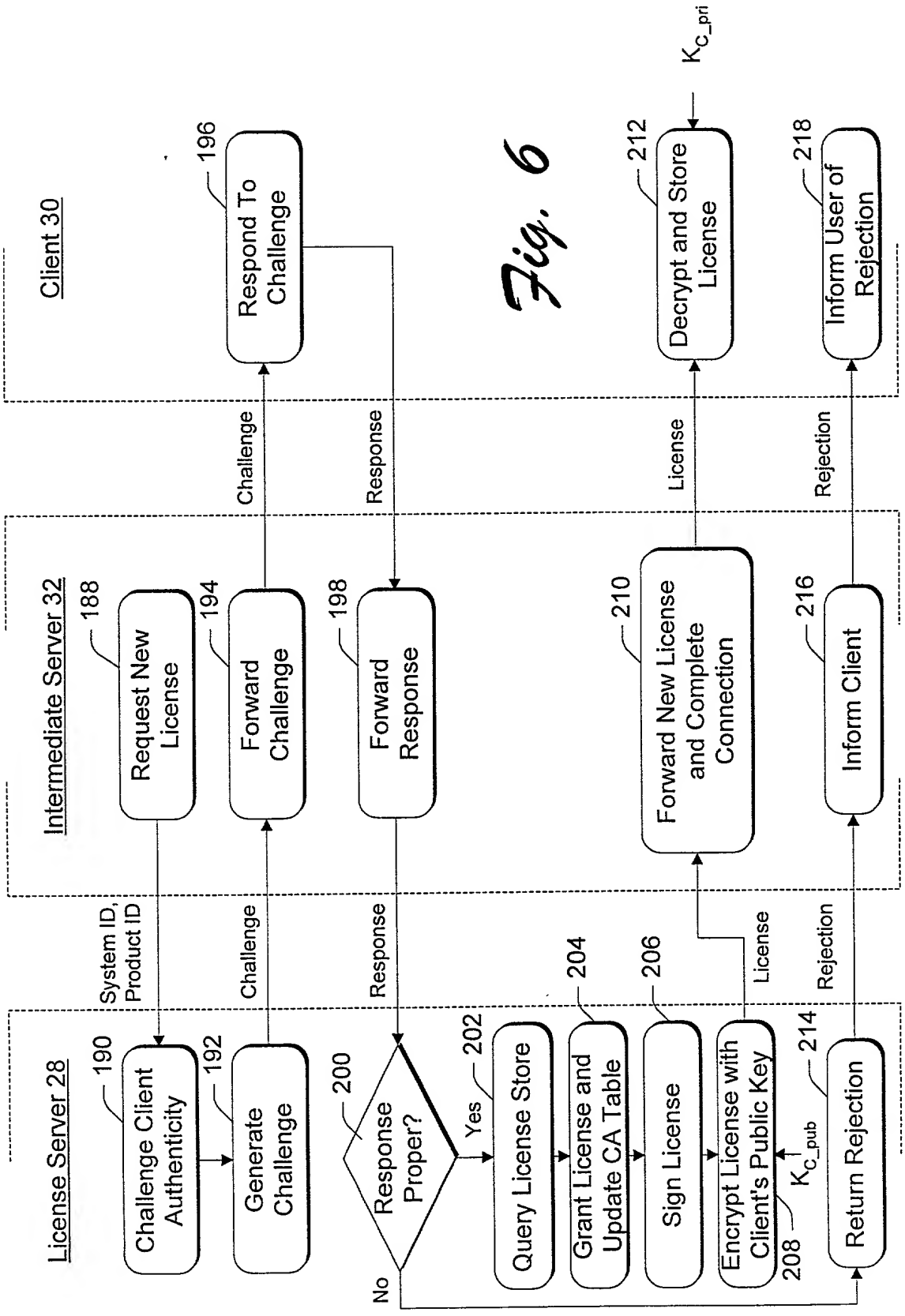
License Server 28
Challenge Client Authenticity
190
Generate Challenge
192
Response Proper?
200
Yes
No
Query License Store
202
Grant License and Update CA Table
204
Sign License
206
Encrypt License with Client's Public Key
208
K_{C_pub}
Return Rejection
214
System ID, Product ID
Challenge
Response
License
Rejection
Intermediate Server 32
Request New License
188
Forward Challenge
194
Forward Response
198
Forward New License and Complete Connection
210
Inform Client
216
Client 30
Respond To Challenge
196
Decrypt and Store License
212
K_{C_pri}
Inform User of Rejection
218

Fig. 6

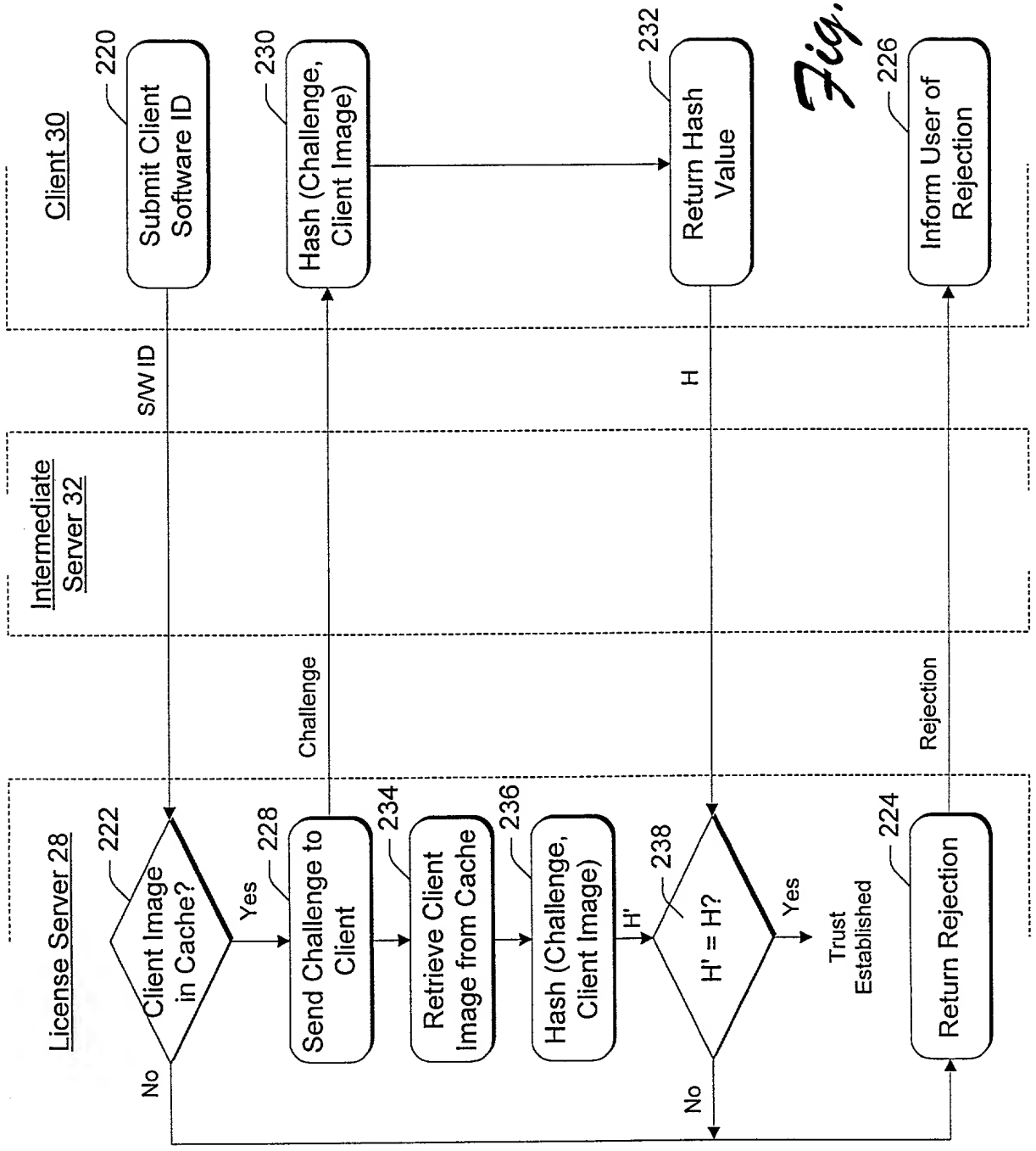
Client 30
Intermediate Server 32
License Server 28
220
Submit Client Software ID
S/W ID
230
Hash (Challenge, Client Image)
232
Return Hash Value
H
226
Inform User of Rejection
222
Client Image in Cache?
Yes
228
Send Challenge to Client
Challenge
234
Retrieve Client Image from Cache
236
Hash (Challenge, Client Image)
H'
238
H' = H?
Yes
Trust Established
No
224
Return Rejection
Rejection
No

Fig. 7

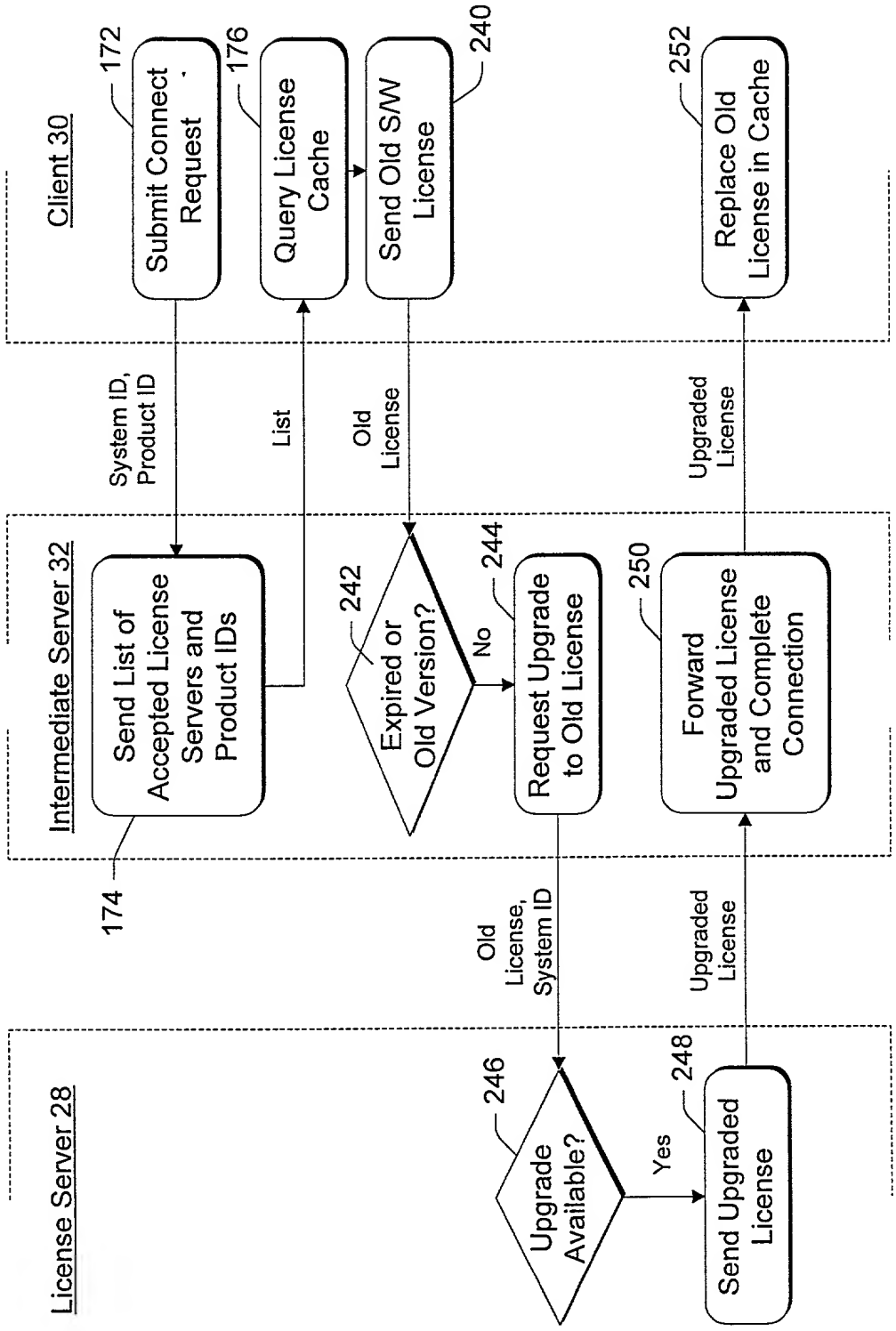
Client 30
172
Submit Connect Request
176
Query License Cache
240
Send Old S/W License
252
Replace Old License in Cache
System ID, Product ID
List
Old License
Upgraded License
Intermediate Server 32
Send List of Accepted License Servers and Product IDs
242
Expired or Old Version?
No
244
Request Upgrade to Old License
250
Forward Upgraded License and Complete Connection
174
Old License, System ID
Upgraded License
License Server 28
246
Upgrade Available?
Yes
248
Send Upgraded License

Fig. 8

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No. 09/040,813
Filing Date 3/18/98
Inventorship ..... Misra et al.
Applicant ..... Microsoft Corporation
Attorney's Docket No. MS1-197US
Title: System and Method for Software Licensing

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "System and Method for Software Licensing" referenced above.

I have reviewed and understand the content of the above-identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

PRIOR FOREIGN APPLICATIONS: no applications for foreign patents or inventor's certificates have been filed prior to the date of execution of this declaration.

Power of Attorney

I appoint the following attorneys to prosecute this application and transact all future business in the Patent and Trademark Office connected with this application:

Lewis C. Lee, Reg. No. 34,656; Daniel L. Hayes, Reg. No. 34,618; Katie E. Sato, Reg. No. 32,628 and Daniel D. Crouse, Reg. No. 32,022.

Send correspondence to: LEE & HAYES, PLLC, W. 201 North River Drive, Suite 430, Spokane, Washington, 99201. Direct telephone calls to: Lewis C. Lee (509) 324-9256.

All statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of the application or any patent issued therefrom.

* * * * * * * * * *

Full name of inventor:	Pradyumna K. Misra
Inventor's Signature	Pradyumna K Misra Date: 5/27/98
Residence:	Redmond, Washington
Citizenship:	USA
Post Office Address:	5020 159th Court NE Redmond, WA 98052

* * * * * * * * * *

Full name of inventor: Bradley J. Graziadio

Inventor's Signature _____ Date: 27-May-98

Residence: Redmond, Washington

Citizenship: USA

Post Office Address: 2827 233rd Place NE
Redmond, WA 98053

* * * * * * * * *

Full name of inventor: Terence R. Spies

Inventor's Signature _____ Date: 5/27/98

Residence: Kirkland, Washington

Citizenship: USA

Post Office Address: 213 5th Ave. West
Kirkland, WA 98033

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PATENT ASSIGNMENT

PARTIES TO THE ASSIGNMENT

Assignor(s):

Pradyumna Misra
5020 159th Court NE
Redmond, WA 98052

Bradley J. Graziadio
2827 233rd Place NE
Redmond, WA 98053

Terence R. Spies
213 5th Ave. West
Kirkland, WA 98033

Assignee:

Microsoft Corporation
Corporation of the State of Washington
One Microsoft Way
Redmond, WA 98052-6399

AGREEMENT

WHEREAS, Assignor(s) are inventor(s) of an invention entitled System and Method for Software Licensing," as described and claimed in the specification forming part of an application for United States letters patent referenced above;

WHEREAS, Microsoft, a corporation of the State of Washington having a place of business at One Microsoft Way, Redmond, WA 98052, is desirous of acquiring the entire right, title and interest in and to the invention and in and to any

letters patent that may be granted therefor in the United States and in any and all foreign countries;

NOW, THEREFORE, in exchange for good and valuable consideration, the receipt of which is hereby acknowledged, Assignor(s) hereby sell, assign and transfer unto Microsoft, the entire right, title and interest in and to said invention, said application and any and all letters patent which may be granted for said invention in the United States of America and its territorial possessions and in any and all foreign countries, and in any and all divisions, reissues and continuations thereof, including the right to file foreign applications directly in the name of Microsoft and to claim priority rights deriving from said United States application to which said foreign applications are entitled by virtue of international convention, treaty or otherwise, said invention, application and all letters patent on said invention to be held and enjoyed by Microsoft and its successors and assigns for their use and benefit and of their successors and assigns as fully and entirely as the same would have been held and enjoyed by Assignor(s) had this assignment, transfer and sale not been made. Assignor(s) hereby authorize and request the Commissioner of Patents and Trademarks to issue all letters patent on said invention to Microsoft. Assignor(s) agree to execute all instruments and documents required for the making and prosecution of applications for United States and foreign letters patent on said invention, for litigation regarding said letters patent, or for the purpose of protecting title to said invention or letters patent therefor.

* * * * * * * * * *

5/27/98 — Pradyumna K. Misra
Date — Pradyumna K. Misra

State of Washington)
) ss.
County of King)

I certify that I know or have satisfactory evidence is the person Pradyumna K. Misra who appeared before me, and said person acknowledged that he signed this instrument and acknowledged it to be his free and voluntary act for the uses and purposes mentioned in the instrument.

Dated May 27, 1998

Signature of Notary Public Melissa Whitmore

My appointment expires December 30, 2001

MELISSA WHITMORE COMMISSION EXPIRES NOTARY -*- PUBLIC DECEMBER 30, 2001 STATE OF WASHINGTON

* * * * * * * * * *

22-May-98 — Bradley J. Graziadio
Date — Bradley J. Graziadio

State of Washington)
) ss.
County of King)

I certify that I know or have satisfactory evidence is the person Bradley J. Graziadio who appeared before me, and said person acknowledged that he signed this instrument and acknowledged it to be his free and voluntary act for the uses and purposes mentioned in the instrument.

Dated May 27, 1998

Signature of Notary Public Melissa Whitmore

My appointment expires December 30, 2001

MELISSA WHITMORE COMMISSION EXPIRES NOTARY -*- PUBLIC DECEMBER 30, 2001 STATE OF WASHINGTON

* * * * * * * * * * *

5-27-98
Date

Terence R. Spies

State of Washington)
) ss.
County of King)

I certify that I know or have satisfactory evidence Terence R. Spies is the person who appeared before me, and said person acknowledged that he signed this instrument and acknowledged it to be his free and voluntary act for the uses and purposes mentioned in the instrument.

Dated May 27, 1998

Signature of
Notary Public Melissa Whitmore

My appointment expires December 30, 2001

MELISSA WHITMORE
NOTARY PUBLIC
STATE OF WASHINGTON
COMMISSION EXPIRES
DECEMBER 30, 2001